# SOIL SURVEY OF

# Stillwater County Area, Montana

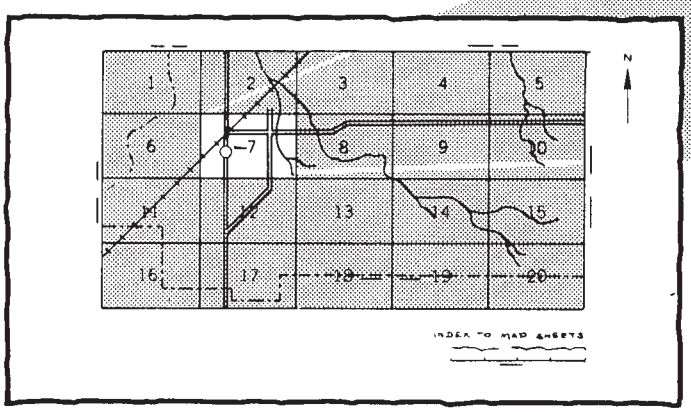
**United States Department of Agriculture**
**Soil Conservation Service**

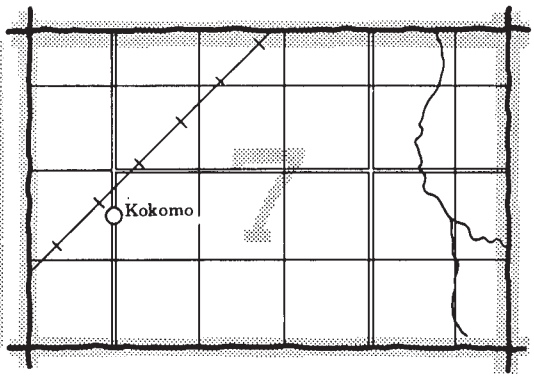
in cooperation with

**Montana Agricultural Experiment Station**

# HOW TO USE

**1.** Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).




**2.** Note the number of the map sheet and turn to that sheet.

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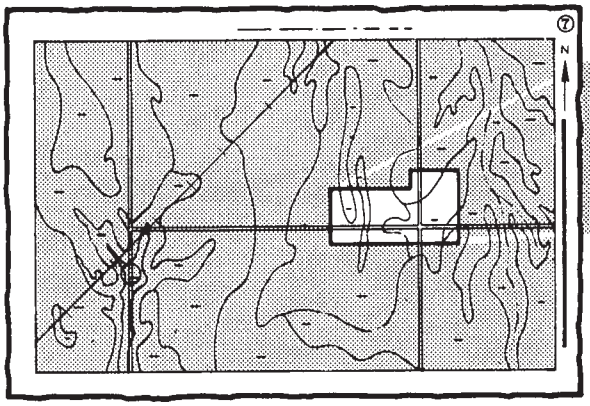


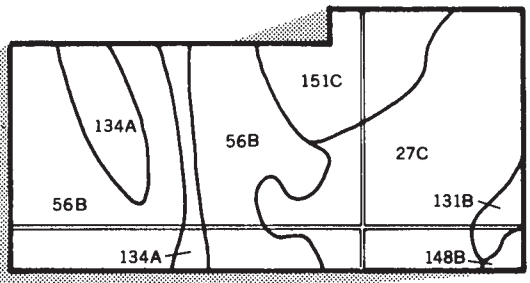


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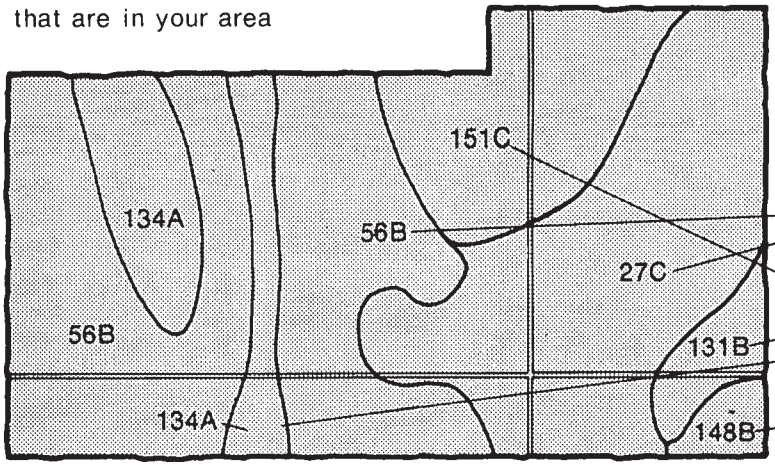
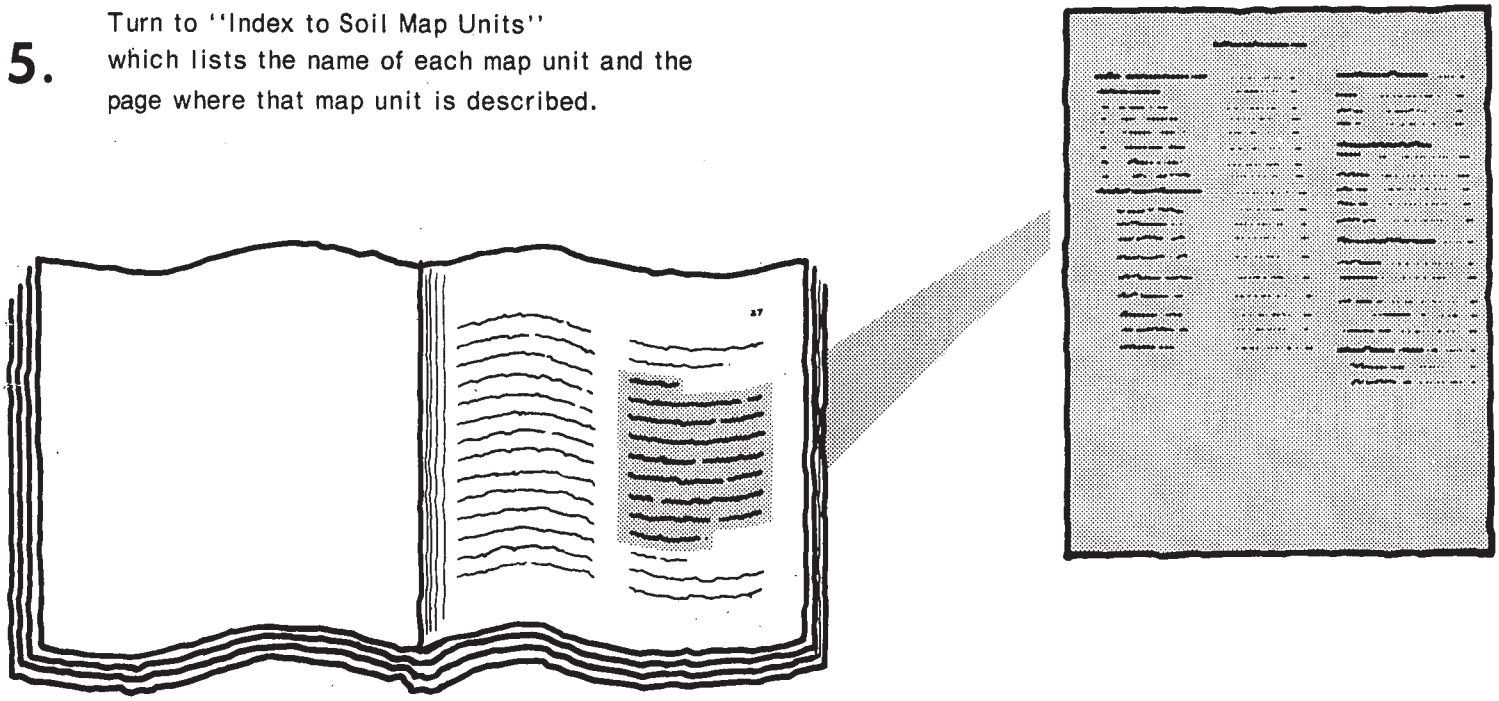



## Symbols

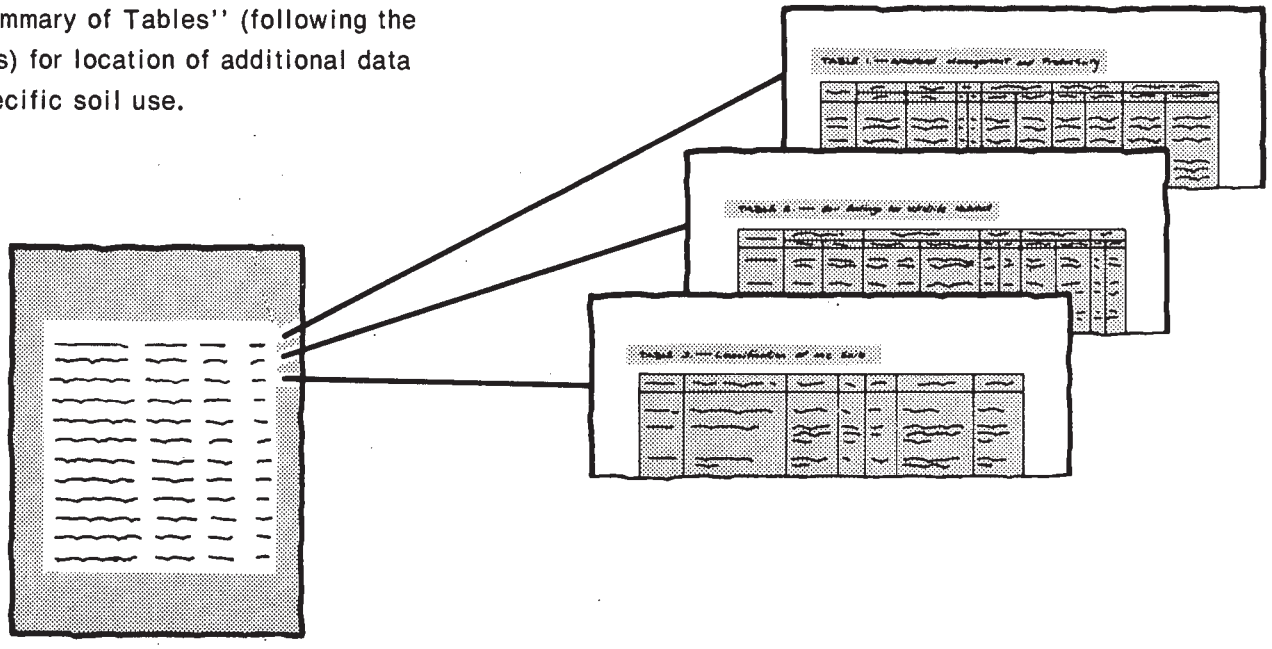
27C
56B
131B
134A
148B
151C

# THIS SOIL SURVEY

**5.** Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



**6.** See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



**7.** Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1969 to 1972. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1973. This survey was made cooperatively by the Soil Conservation Service and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Stillwater Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

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# Foreword

This soil survey contains much information useful in land-planning programs in the Stillwater County Area. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

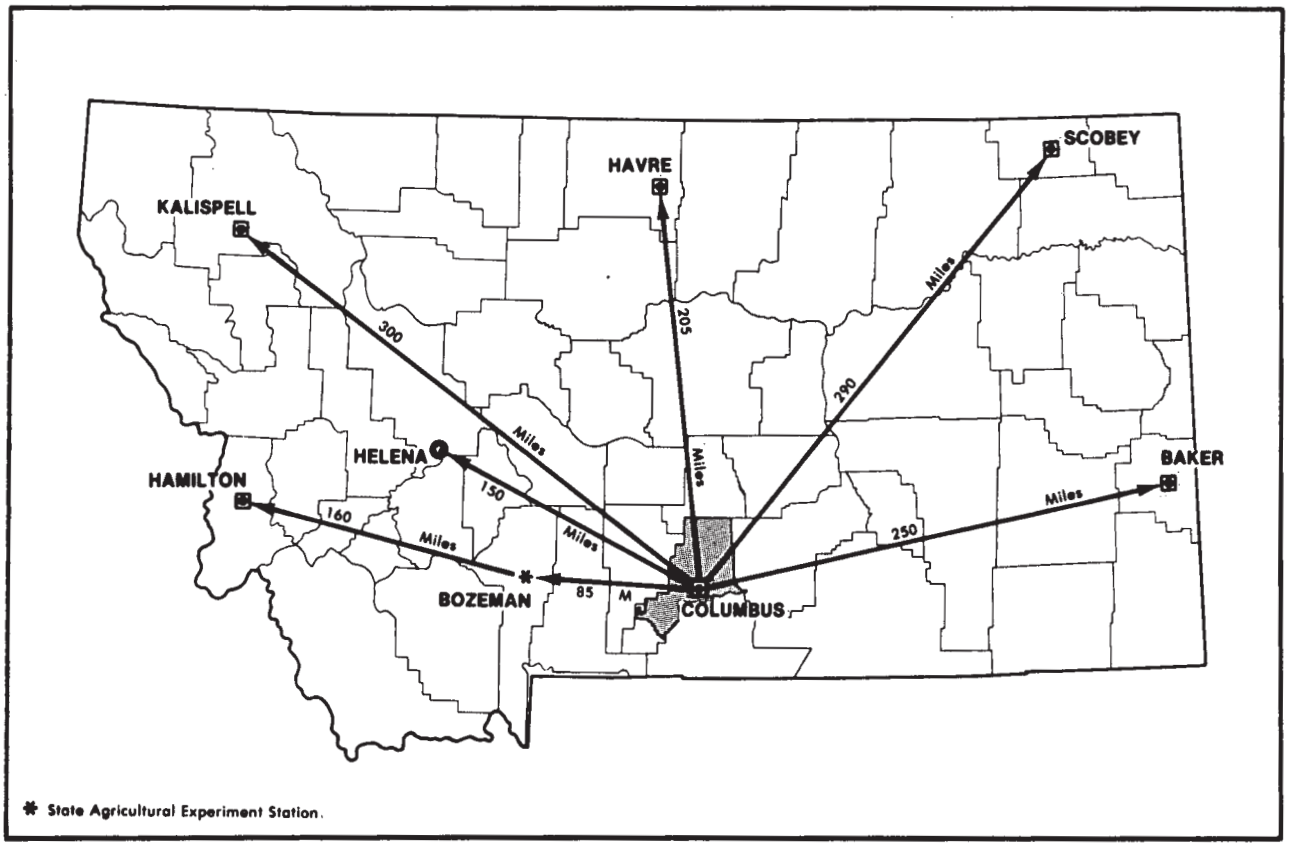
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Van K. Haderlie
State Conservationist
Soil Conservation Service




**Location of Stillwater County Area in Montana.**

# SOIL SURVEY OF STILLWATER COUNTY AREA, MONTANA

By John L. Parker, Gordon L. Decker, and Michael T. Jackson,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
in cooperation with the Montana Agricultural Experiment Station

STILLWATER COUNTY AREA is in the south-central part of Montana. It takes in about 957,440 acres, or 1,496 square miles. Columbus, the county seat, is in the central part of Stillwater County.

About 30 percent of the Area is cropland, and the rest is used mainly for range. The principal crops are wheat, barley, oats, hay, sugar beets, and corn silage. Raising beef cattle, small grains, corn silage, and sugar beets are the main enterprises.

## How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Description of the soils."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, home buyers, and those seeking recreation.

## General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most

part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. Some are suitable for dryland or irrigated crops; others are better suited to rangeland or to wildlife habitat or recreation.

## Deep, nearly level to moderately sloping, well drained soils on low terraces, alluvial fans, and flood plains

These soils are on low terraces, alluvial fans, and flood plains along the Yellowstone River, Stillwater River, and Rosebud Creek. They formed in alluvium and have a surface layer of loam, clay loam, fine sandy loam, or silty clay loam. Annual precipitation is 10 to 19 inches. The frost-free period is 90 to 130 days. The soils in the Yellowstone Valley are used mainly for dryland or irrigated crops. The soils in the Stillwater River Valley and Rosebud Creek Valley are used mainly for irrigated and dryland hay and for range.

### 1. Havre-Harlem-Glendive

*Deep, nearly level or gently sloping, well drained loams, clay loams, and fine sandy loams that formed in alluvium; on flood plains, alluvial fans, and terraces*

This map unit is in the Yellowstone Valley, mainly near the Yellowstone River. It makes up about 1 percent of the survey area. The map unit is about 35 percent Havre soils, 30 percent Harlem soils, 25 percent Glendive soils, and 10 percent minor soils.

Havre soils are level or gently sloping and occupy stream terraces, alluvial fans, and flood plains. The surface layer is typically light brownish gray loam 6 inches thick. The underlying material is light brownish gray loam with strata of silt, very fine sand, and clay.

Harlem soils are level and occupy stream terraces and flood plains. The surface layer typically is dark grayish brown clay loam 4 inches thick. The underlying material is grayish brown, brown, and olive gray clay loam and clay.

Glendive soils are nearly level and gently sloping and occupy terraces and flood plains. The surface layer typically is light brownish gray fine sandy loam 6 inches thick. The underlying material is light brownish gray sandy loam with strata of silt loam, loamy sand, and clay.

Minor soils in this map unit are in the Kobar and Yamac series and Ustifluvents-Fluvaquents association, flooded. The Kobar and Yamac soils are deep, well drained soils on terraces. The Ustifluvents and Fluvaquents are on flood plains, mainly adjacent to the river, and consist of poorly drained to well drained soils and soils that have gravel and sand at a depth of less than 20 inches or more than 40 inches.

These soils are used for dryland and irrigated crops and for range.

### 2. Yamac-Kobar-Attewan

*Deep, nearly level to moderately sloping, well drained loams and clay loams that formed in alluvium; on fans and terraces*

This map unit is in the Yellowstone Valley. It comprises about 4 percent of the Area. The map unit is about 50 percent Yamac soils, 25 percent Attewan soils, 15 percent Kobar soils, and 10 percent minor soils.

Yamac soils are nearly level to moderately sloping and are on foot slopes and alluvial fans. The surface layer is typically grayish brown loam 8 inches thick. The subsoil is brown and light brownish gray loam 12 inches thick. The substratum is light brownish gray loam and clay loam.

Kobar soils are nearly level to moderately sloping and occupy terraces, foot slopes, and alluvial fans. The surface layer is light brownish gray clay loam 5 inches thick. The subsoil is grayish brown silty clay loam and silty clay 25 inches thick. The substratum is grayish brown clay.

Attewan soils are nearly level or gently sloping and occupy terraces. They are underlain by sand and gravel at a depth of 20 to 40 inches. The surface layer is typically grayish brown and brown loam 9 inches thick. The subsoil is brown clay loam 9 inches thick. The substratum is light brownish gray loam over loose sand and gravel.

The minor soils in this map unit are the Beaverell, Glendive, and Harlem soils on terraces. The Beaverell soils are deep, gravelly loams and have loose, very gravelly sand at a depth of 10 to 20 inches. The Glendive soils are deep, fine sandy loams that formed in stratified sandy loam alluvium. Harlem soils are deep clay loams that formed in clay loam and clay alluvium.

These soils are used for irrigated and dryland crops and for range.

### 3. Lolo-Shawa-Nesda

*Deep, nearly level to moderately sloping, well drained gravelly loams and silty clay loams that formed in alluvium; on flood plains, terraces, and alluvial fans*

This map unit is in the Stillwater River Valley and Rosebud Creek Valley. It makes up about 2 percent of the Area. The map unit is about 40 percent Lolo soils, 25 percent Shawa soils, 20 percent Nesda soils, and 15 percent minor soils.

Lolo soils are nearly level to moderately sloping and occupy stream terraces and flood plains. The surface layer typically is dark grayish brown very gravelly loam 13 inches thick. The subsoil is dark brown very gravelly

loam 11 inches thick. The substratum is light brownish gray very gravelly fine sandy loam.

Shawa soils are nearly level to moderately sloping and occupy terraces and alluvial fans. The surface layer typically is very dark gray and dark gray silty clay loam and clay loam 25 inches thick. The underlying material is grayish brown clay loam.

Nesda soils are nearly level and occupy flood plains and alluvial fans. The surface layer typically is dark grayish brown, dark brown, and brown gravelly loam 16 inches thick. The underlying material is pale brown very cobbly sand.

Minor soils in this map unit are the deep Lohler, Work, and Turner soils that formed in alluvium. The Lohler soils are clay loam, and the Work soils are loam. Turner soils are clay loam or stony clay loam underlain by loose very gravelly sand at a depth of 20 to 40 inches.

These soils are used mainly for range. Some areas are used for irrigated hay.

## Deep, nearly level, somewhat poorly drained and poorly drained, saline soils in closed basins

These soils are in closed basins near Rapelje. They formed in saline loamy and clayey sediments and have a clay loam or clay surface layer. Annual precipitation is 10 to 14 inches. The frost-free period is 110 to 120 days. The soils are used mainly for range and wildlife.

### 4. Lardell-McKenzie

*Deep, nearly level, somewhat poorly drained to poorly drained clay loams and clays that formed in alluvium; in closed basins and on flood plains and terraces*

This map unit is in the northeastern part of Stillwater County. It makes up about 2 percent of the survey area. The map unit is about 45 percent Lardell soils, 40 percent McKenzie soils, and 15 percent minor soils.

Lardell soils are somewhat poorly drained or poorly drained soils on fans and in closed basins. The surface layer typically is light grayish brown clay loam 7 inches thick. The underlying material is grayish brown and olive silty clay loam and clay loam.

McKenzie soils are poorly drained soils in closed basins. The surface layer typically is light olive gray clay 4 inches thick. The subsoil is olive gray and light olive gray clay 13 inches thick. The substratum is light olive gray mottled clay.

Minor soils in this map unit are in the Absher, Kobar, and Lonna series. The Absher soils are deep, well drained, silty clay loams that formed in clayey alluvium and are high in sodium. Kobar soils are deep, well drained clay loams that formed in clayey alluvium. The Lonna soils are deep, well drained silt loams that formed in silty alluvium. They occupy alluvial fans and terraces mainly bordering the closed basins.

The soils in this map unit are used mainly for range. Some areas of the minor soils are dryfarmed.

## Shallow to deep, gently sloping to very steep, well drained soils on sandstone and shale uplands

These soils are on uplands and terraces. They formed in colluvium, alluvium, and residuum of weathered sandstone and shale. They have a surface layer of clay loam, channery loam, cobbly sandy loam, or loam. The average annual precipitation is 10 to 19 inches. The frost-free period is 90 to 130 days. The soils are used mainly for dryland crops and for range.

### 5. Yawdim-Lambeth-Birney

*Shallow to deep, moderately steep to very steep, well drained clay loams, silt loams, and channery loams that formed in material weathered from shale; on uplands*

This map unit is on the uplands in the northern part of the county. It makes up about 14 percent of the survey area. The map unit is about 35 percent Yawdim soils, 30 percent Lambeth soils, 20 percent Birney soils, and 15 percent minor soils.

The shallow Yawdim soils are steep and very steep and occupy hillsides along breaks. The surface layer typically is light brownish gray clay loam 2 inches thick. The underlying material is light gray clay loam 8 inches thick over shale.

The deep Lambeth soils are steep and occupy hillsides and ridgetops. The surface layer typically is light brownish gray silt loam 8 inches thick. The underlying material is light gray and light brownish gray silt loam.

The deep Birney soils are steep and occupy hillsides and foot slopes. The surface layer typically is brown channery loam 4 inches thick. The subsoil is yellowish brown channery loam 10 inches thick. The substratum is pale brown channery loam and very channery sandy loam.

Of minor extent in this map unit are the Rentsac, Tanna, and Yamac soils, Torrifluvents-Camborthids, and Rock outcrop. The Rentsac soils are shallow, well drained loams that are underlain by sandstone and are on ridgetops and hillsides. The Tanna soils are moderately deep, well drained clay loams on ridgetops. The Yamac soils are on alluvial fans in the narrow valleys and are deep, well drained loams. The Torrifluvents and Camborthids are on alluvial fans and narrow flood plains.

These soils are used for range and, to a lesser extent, for woodland.

### 6. Absarokee-Sinnigam-Castner

*Moderately deep and shallow, gently sloping to steep, well drained clay loams and loams that formed in material weathered from shale and sandstone; on uplands*

This map unit is in the south-central part of the county. It occupies hillsides, ridges, and plains in the uplands. This map unit comprises about 15 percent of the survey area. It is about 50 percent Absarokee soils, 20 percent Sinnigam soils, 15 percent Castner soils, and 15 percent minor soils.

The moderately deep Absarokee soils are gently sloping to steep and occupy plains, ridgetops, and hillsides. The surface layer typically is dark grayish brown clay loam 6 inches thick. The subsoil is grayish brown clay loam and clay 17 inches thick. The substratum is light olive gray clay loam 12 inches thick and is underlain by sandstone.

The shallow Sinnigam soils are gently sloping to steep and occupy ridgetops and hillsides. The surface layer typically is dark grayish brown clay loam and channery clay loam 5 inches thick. The subsoil is grayish brown very channery silty clay that is underlain by interbedded shale and sandstone at a depth of 18 inches.

The shallow Castner soils occupy gently sloping to steep ridgetops and hillsides. The surface layer typically is dark grayish brown and brown loam 10 inches thick. The underlying material is light gray very channery loam that is underlain by sandstone at a depth of 18 inches.

Of minor extent in this map unit are the Grail, Hilger, and Work soils, Ustifluvents-Ustochrepts, and Rock outcrop. The Grail soils are deep, well drained soils that formed in silty clay loam and clay loam alluvium and are mainly in concave positions. The Hilger soils are deep, well drained soils that formed in colluvium and alluvium and are mainly on foot slopes. The Work soils are deep, well drained soils that formed in clay loam and gravelly loam alluvium on fans. The Ustifluvents and Ustochrepts are on alluvial fans and flood plains in narrow valleys. Rock outcrop occurs on some steep hillsides.

The soils in this map unit are used for range and for dryland crops.

### 7. Tanna-Rentsac-Bonfri

*Moderately deep or shallow, gently sloping to moderately steep, well drained clay loams and loams that formed in material weathered from sandstone and shale; on uplands*

This map unit is north of the Yellowstone Valley. It makes up about 44 percent of the county. The map unit is about 40 percent Tanna soils, 20 percent Rentsac soils, 15 percent Bonfri soils, and 25 percent minor soils.

The moderately deep Tanna soils are gently sloping to moderately steep and occupy plains, ridgetops, and hillsides of uplands. The surface layer is typically grayish brown clay loam 7 inches thick. The subsoil is light olive brown and light yellowish brown silty clay and clay loam 13 inches thick. The substratum is light olive gray clay loam 14 inches thick that overlies shale.

The shallow Rentsac soils are gently sloping to moderately steep and occupy plains, ridgetops, and hillsides of uplands. The surface layer is grayish brown loam 8 inches thick. The underlying material is light brownish gray and light gray very channery loam 10 inches thick and overlies sandstone.

The moderately deep Bonfri soils are gently sloping to moderately steep and occupy plains, ridgetops, and hillsides of uplands. The surface layer is grayish brown loam 7 inches thick. The subsoil is grayish brown clay loam 21 inches thick. The substratum is light brownish gray clay loam 8 inches thick that overlies shale.

Minor soils in this map unit are in the Beenom, Lambeth, Lonna, and Yamac series. The Beenom soils are shallow loams underlain by sandstone. Lambeth soils are deep, clay loam and silt loam soils that weathered from shale. Lonna soils are deep silt loams that formed in alluvium. Yamac soils are deep loams that formed in alluvium.

These soils are used for dryland farming and for range.

### 8. Hilger-Castner-Turner

*Deep to shallow, gently sloping to steep, well drained cobbly sandy loams, loams, and clay loams that formed in material weathered from sandstone and shale and in gravelly alluvium; on hillsides, ridgetops, and broad divides and terraces on uplands*

This map unit is mainly in the southwestern part of Stillwater County. It makes up about 16 percent of the survey area. The map unit is about 35 percent Hilger soils, 30 percent Castner soils, 20 percent Turner soils, and 15 percent minor soils.

The deep Hilger soils occupy steep hillsides and foot slopes. The surface layer typically is brown cobbly sandy loam 4 inches thick. The subsoil is brown and pale brown very cobbly sandy clay loam 20 inches thick. The substratum is brown very cobbly loam.

The shallow Castner soils are moderately sloping to steep and occupy hillsides and ridges. Typically the surface layer is dark grayish brown and brown loam 10 inches thick. The underlying material is light gray very channery loam underlain by sandstone bedrock at a depth of 18 inches.

The deep Turner soils are gently sloping to moderately sloping and occupy high outwash terraces on broad divides in the uplands. The surface layer typically is brown clay loam 3 inches thick. The subsoil is dark yellowish brown clay 8 inches thick. The substratum is light brownish gray clay loam 11 inches thick over loose very gravelly sand.

Of minor extent in this map unit are Absarokee, Amherst, and Shane soils and Ustifluvents-Ustochrepts. The Absarokee soils are moderately deep clay loams underlain by sandstone. Amherst soils are shallow loams underlain by sandstone. The Shane soils are moderately deep clay loams underlain by shale. These soils are on ridges and the upper parts of hillsides. The Ustifluvents and Ustochrepts occur on alluvial fans and narrow flood plains in the narrow valleys.

These soils are used for range and for dryland farming.

## Deep, moderately sloping to very steep, well drained soils on mountains

These soils are on mountain ridgetops, side slopes, and foothills. They formed in colluvium, residuum, and glacial till and have a stony loam or gravelly sandy loam surface

layer. The average annual precipitation is 15 to 24 inches, and the frost-free period is 60 to 90 days. These soils are mainly used for timber production, for range, and for wildlife.

**9. Sebud-Garlet-Rock outcrop**

*Rock outcrop and deep, moderately sloping to very steep, well drained stony loams and gravelly sandy loams that formed in material weathered from sandstone and igneous rock and in glacial till; on foothills, mountainsides, and ridgetops*

This map unit is in the southwestern part of the Area in the Beartooth Mountains. It makes up about 2 percent of the survey area. The map unit is about 50 percent Sebud soils, 25 percent Garlet soils, 15 percent Rock outcrop, and 10 percent minor soils.

The deep Sebud soils are moderately sloping to very steep and occupy ridgetops, foothills, and mountainsides. They formed in glacial till or alluvium and colluvium derived from glacial till. Typically, the surface layer is very dark grayish brown and dark grayish brown stony loam 10 inches thick. The subsoil is yellowish brown extremely stony clay loam 14 inches thick. The substratum is very pale brown extremely stony sandy clay loam.

The deep Garlet soils are steep and very steep and occupy mountainsides and ridgetops. Typically, the surface layer is light brownish gray gravelly sandy loam 12 inches thick. The subsoil to a depth of 60 inches is pale brown gravelly sandy loam and very cobbly loam.

Rock outcrop is mainly on the mountain slopes and on the tops of ridges. It consists of either igneous or sedimentary rocks.

Minor soils in this map unit are in the Cheadle and Shawa series. The Cheadle soils are shallow and are underlain by sandstone or igneous rock. They are mainly on the side slopes and ridgetops. The Shawa soils are deep, well drained soils that formed on stream terraces and alluvial fans.

These soils are used for range, woodland, and wildlife.

## Description of the soils

In this section the soil series and map units in the Stillwater County Area are described. The approximate acreage and extent of each map unit are given in table 1.

The soil series is described first and then the map units in the series. To get full information on any one map unit, it is necessary to read the description of the map unit and the description of the soil series to which the unit belongs. The description of a soil series mentions features that apply to all soils in the series. Differences among soils of a series are pointed out in the descriptions of the map units or are indicated in the soil name. Soils that are mapped only in a complex or association are described under the name of the complex or association. Unless otherwise stated, the descriptions of the map units in this section are for dry soils. Not all map units are members of a soil series. For example, Rock outcrop is a miscellaneous area and does not belong to a soil series. It is nevertheless listed in alphabetic order along with the series.

An essential part of each soil series is the description of the soil profile, that is, the sequence of layers beginning at the surface and continuing down to a depth beyond which roots of most plants penetrate. Each soil series contains a short description of a typical soil profile and a much more detailed description of the same profile that scientists, engineers, planners, and others can use in making technical interpretations.

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Some of the map units are broadly defined. In the tables, these are indicated by an asterisk following the symbol. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of a soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Absarokee series, for example, was named for the town of Absarokee in Stillwater County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Turner clay loam, 2 to 4 percent slopes, is one of several phases within the Turner series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Tanna-Rentsac complex, 4 to 15 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pat-

tern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Sebud-Cheadle association, very steep, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Lolo and Nesda soils, flooded, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Listed at the end of each description of a map unit is the capability unit in which the map unit has been placed. For those map units that have been placed in a windbreak suitability group or range site, that group is also listed. Many terms used in the soil descriptions and other sections of the survey are defined in the Glossary at the back of this soil survey and in the Soil Survey Manual (*6*).

Some of the frigid soils mapped in the area around the town of Absarokee have a growing season shorter than is typical for the series. Some of the Aridic soils that are mapped at higher elevations north of the Yellowstone River have 15 to 16 inches of precipitation, which is more than is typical for the series.

Soil maps of Yellowstone County, Montana, and Carbon County, Montana, will not necessarily match those in the soil survey of Stillwater County Area, Montana, completed in 1973. New criteria for soil series and their interpretations and new information on climatic conditions have changed concepts of the soil series and mapping.

## Absarokee series

The Absarokee series consists of moderately deep, well drained soils that formed in material weathered from sandstone. These soils are on upland divides and foot slopes at an elevation of 4,000 to 5,000 feet, and are underlain by bedrock at a depth of 20 to 40 inches. Slopes are 2 to 50 percent. Native vegetation was mainly bluebunch wheatgrass, western wheatgrass, rough fescue, Idaho fescue, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 45 to 57 degrees F. The frost-free season is 105 to 120 days.

In a representative profile the surface layer is dark grayish brown clay loam 6 inches thick. The subsoil is grayish brown clay loam and clay 17 inches thick. The substratum is light olive gray clay loam 12 inches thick. It overlies hard sandstone.

Permeability is moderately slow to a depth of about 35 inches, and the available water capacity is low. Reaction is neutral to a depth of 23 inches and moderately alkaline below that depth.

These soils are used mainly for dryland crops, range, pasture, and wildlife.

Representative profile of Absarokee clay loam, 2 to 8 percent slopes, 1,600 feet east and 500 feet south of northwest corner of sec. 11, T. 3 S., R. 20 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; neutral; clear wavy boundary.

B21t—6 to 11 inches; grayish brown (10YR 5/2) heavy clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure that separates to moderate medium angular blocky; hard, firm, sticky and plastic; thin continuous clay films on peds and coatings on sand grains; many fine and very fine roots; few medium tubular pores; neutral; gradual smooth boundary.

B22t—11 to 23 inches; grayish brown (10YR 5/2) clay, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; hard, firm, sticky and plastic; thin discontinuous clay films on peds; many very fine roots; few fine tubular pores; neutral; gradual wavy boundary.

Cca—23 to 35 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; massive; slightly hard, friable, sticky and plastic; common very fine roots; many fine and very fine tubular pores; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIR—35 inches; hard sandstone.

Depth to bedrock ranges from 20 to 40 inches. Combined thickness of the A and B horizons ranges from 20 to 27 inches. The B2t horizon is neutral or mildly alkaline.

**1—Absarokee clay loam, 2 to 8 percent slopes.** This gently sloping and moderately sloping soil occupies broad upland divides and foot slopes. It has the profile described as typical of the series.

Included in mapping are a few small areas of Rock outcrop and small areas of Sinnigam and Work soils. Near the Beartooth Mountains the growing season is somewhat shorter than is typical for these soils.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

The soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is also well suited to range. Capability unit IIIe-1 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**2—Absarokee clay loam, 8 to 15 percent slopes.** This strongly sloping soil occupies narrow upland divides and foot slopes. Included in mapping are a few small areas where the surface layer and subsoil are channery clay loam. Also included are small areas where slopes are less than 8 percent or more than 15 percent. Small areas of Sinnigam, Hilger, and Wayden soils are included, as are a few small areas of Rock outcrop. Near the Beartooth Mountains the growing season is somewhat shorter than is typical for the series.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to range. To a lesser degree, it is suited to growing wheat, oats, barley, and hay under dryfarm management. Capability unit IVe-1 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**3—Absarokee-Sinnigam clay loams, 2 to 8 percent slopes.** This complex consists of gently sloping and moderately sloping soils on foot slopes and upland divides. About 65 percent is Absarokee clay loam, and about 30 percent is Sinnigam clay loam. Absarokee clay loam occupies the swales and smooth foot slopes, and Sinnigam clay loam occupies the convex ridges. The Sinnigam soil in this complex has the profile described as typical for the Sinnigam series. The remaining 5 percent of this complex consists of small areas of Work and Shane soils and Rock outcrop. Near the Beartooth Mountains the growing season is somewhat shorter than is typical for the series.

Surface runoff is medium. The water erosion hazard is moderate, and the hazard of wind erosion is slight.

This complex is suited to wheat, barley, and hay production under dryfarm management. It is also suited to range. Capability unit IIIe-1 (dryland); Absarokee soils in Clayey range site, 15- to 19-inch precipitation zone, windbreak suitability group 3M; Sinnigam soils in Shallow range site, 15- to 19-inch precipitation zone, windbreak suitability group 4.

**4—Absarokee-Sinnigam clay loams, 8 to 15 percent slopes.** This complex consists of strongly sloping soils on foot slopes and upland divides. About 55 percent is Absarokee clay loam, and about 35 percent is Sinnigam clay loam. Absarokee clay loam occupies the swales and smooth foot slopes, and Sinnigam clay loam occupies the convex ridges. The remaining 10 percent of this complex consists of small areas of Work and Shane soils and Rock outcrop. Near the Beartooth Mountains the growing season is somewhat shorter than is typical for the series.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This complex is suited to wheat, barley, and hay production under dryfarm management. It is also suited to range. Capability unit IVe-1 (dryland); Absarokee soil in Clayey range site, 15- to 19-inch precipitation zone, windbreak suitability group 3M; Sinnigam soil in Shallow range site, 15- to 19-inch precipitation zone, windbreak suitability group 4.

**5—Absarokee-Sinnigam complex, 15 to 50 percent slopes.** This map unit consists of moderately steep to very steep soils on foot slopes and upland divides. About 45 percent is Absarokee clay loam, and about 35 percent is Sinnigam channery clay loam. Absarokee clay loam occupies the smooth foot slopes, and Sinnigam channery clay loam occupies the convex slopes. The remaining 20 percent is mostly Wayden and Hilger soils and sandstone outcrops. Also included are small areas of Turner soil on the crests of knolls and ridges and small benches. Many of these areas are used as a source of sand and gravel. The Absarokee soil in this complex has a profile similar to that described as typical for the series, except that the depth to bedrock is mainly 20 to 30 inches. Near the Beartooth Mountains the growing season is somewhat shorter than is typical for the series.

Surface runoff is rapid, and the water erosion hazard is severe. The hazard of wind erosion is slight.

Soils in this complex are suited to range. Capability unit VIe-1 (dryland); windbreak suitability group 4; Absarokee soil in Clayey range site, 15- to 19-inch precipitation zone, Sinnigam soil in Shallow range site, 15- to 19-inch precipitation zone.

**6—Absarokee-Amherst-Castner complex, 4 to 8 percent slopes.** This complex consists of moderately sloping soils on narrow upland divides and smooth foot slopes. About 40 percent is Absarokee clay loam, 25 percent is Amherst loam, and 20 percent is Castner loam. Absarokee clay loam is on the smooth foot slopes and in the somewhat concave positions. Amherst and Castner soils are on the convex ridges, narrow divides, and knolls. They have profiles described as typical for their respective series. Included in mapping is about 15 percent Work, Hilger, and Shane soils and small areas of Rock outcrop.

Surface runoff is medium, and the erosion hazard is moderate. The hazard of wind erosion is slight. Near the Beartooth Mountains the growing season is somewhat shorter than is typical for the series.

Soils in this complex are suited to wheat, barley, oats, and hay production under dryfarm management. They are also suited to range. Capability unit IIIe-1 (dryland); Absarokee soils in Clayey range site, 15- to 19-inch precipitation zone, windbreak suitability group 3M; Amherst and Castner soils in Shallow range site, 15- to 19-inch precipitation zone, windbreak suitability group 4.

## Absher series

The Absher series consists of deep, well drained soils that formed in alluvium and material weathered from shale. Absher soils are on stream terraces, fans, and uplands at an elevation of 4,000 to 4,500 feet. Slopes are 0 to 6 percent. The native vegetation was mainly western wheatgrass, inland saltgrass, greasewood, annual forbs, saltbush, and other shrubs. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 42 to 47 degrees F. The frost-free season is 105 to 120 days.

In a representative profile the surface layer is grayish brown silty clay loam 2 inches thick. The subsoil is grayish brown silty clay loam and clay loam 16 inches thick. The substratum is light brownish gray and light gray clay to a depth of 60 inches or more.

Permeability is very slow to a depth of 60 inches, and the available water capacity is moderate or high. Reaction is mildly alkaline to a depth of 5 inches and is strongly alkaline below that depth.

These soils are used mainly for range.

Representative profile of Absher silty clay loam, 0 to 6 percent slopes, in native grass, 300 feet east, 50 feet south of northwest section corner of sec. 17, T. 3 N., R. 20 E.

A2—0 to 2 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; many clean silt and sand grains; mildly alkaline; clear wavy boundary.

B21t—2 to 5 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium columnar structure that separates to moderate medium and fine angular blocky; hard, friable, sticky and plastic; many fine and very fine roots; few fine and very fine pores; few discontinuous clay films; many clean and unstained silt grains on peds; mildly alkaline; clear wavy boundary.

B22t—5 to 11 inches; grayish brown (10YR 5/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure that separates to moderate medium and fine subangular blocky; hard, firm, sticky and plastic; common fine and very fine roots and pores; many thin continuous clay films on peds; strongly alkaline; clear wavy boundary.

B3cs—11 to 18 inches; grayish brown (10YR 5/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; weak medium and fine angular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots and pores; few thin discontinuous clay films; many fine lime masses and small nodules of gypsum; strongly effervescent; strongly alkaline; gradual wavy boundary.

C1cs—18 to 52 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; hard, friable, sticky and plastic; few very fine roots; many white gypsum crystals in pockets and seams; strongly effervescent; strongly alkaline; gradual wavy boundary.

C2cs—52 to 60 inches; light gray (10YR 7/2) clay, light olive gray (5Y 6/2) moist; massive; hard, friable, sticky and plastic; weakly effervescent; strongly alkaline.

Depth to accumulated and segregated lime and gypsum ranges from 10 to 20 inches. The substratum is clay or clay loam alluvium or is material weathered from bedrock.

**7—Absher silty clay loam, 0 to 6 percent slopes.** This nearly level and moderately sloping soil occupies stream terraces and the lower part of alluvial fans and upland basins.

Included in mapping are a few small areas that have a clay loam surface layer and a clay loam subsoil. Also included are small areas of Tanna soils and small, nearly barren areas that have soluble salts at depths of less than 10 inches. Where the Absher soil is mapped south of the Yellowstone Valley, it receives more precipitation than is typical, but its use and management is the same as in areas mapped north of the Yellowstone Valley.

Surface runoff is slow or medium. The hazard of soil blowing is slight, and the hazard of water erosion is slight or moderate.

This soil is suited to range. Capability unit VIs-1 (dryland); Dense Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

## Amherst series

The Amherst series consists of shallow, well drained soils that formed in materials weathered from sandstone. Amherst soils are on upland divides and foot slopes at elevations of 4,000 to 5,000 feet and are underlain by bedrock at a depth of 6 to 20 inches. Slopes are 2 to 15 percent. Native vegetation was mainly bluebunch wheatgrass, Idaho fescue, rough fescue, green needlegrass, needleandthread, annuals, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 40 to 45 degrees F, and the frost-free season is 105 to 120 days.

In a representative profile the surface layer is grayish brown loam 4 inches thick. The subsoil is dark grayish brown and brown clay loam 11 inches thick. The substratum is olive gray loam that overlies sandstone.

Permeability is moderate, and the available water capacity is very low. Reaction is neutral.

Amherst soils are used mainly for dryland crops and for range.

Representative profile of Amherst loam in an area of Absarokee-Amherst-Castner complex, 4 to 8 percent slopes, in native grass, 1,600 feet west and 1,800 feet south of the northeast section corner of sec. 4, T. 4 S., R. 20 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium platy structure that separates to weak fine granular; soft, friable, nonsticky and nonplastic; many fine and very fine roots; few very fine tubular pores; neutral; clear wavy boundary.

B21t—4 to 10 inches; dark grayish brown (10YR 4/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, sticky and plastic; common very fine and fine roots; few fine pores; common thin clay films on peds and on sand grains; 15 percent sandstone channers; neutral; gradual wavy boundary.

B22t—10 to 15 inches; brown (10YR 5/3) heavy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium and fine angular blocky structure; hard, firm, sticky and plastic; common thin clay films on peds; few fine roots and pores; 15 percent sandstone channers; neutral; gradual smooth boundary.

C—15 to 18 inches; pale olive (5Y 6/3) channery loam, olive gray (5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; 30 percent sandstone channers; gradual wavy boundary.

R—18 inches; hard gray sandstone with a few cracks.

Depth to bedrock ranges from 6 to 20 inches. Sandstone fragments range from 15 to 30 percent throughout the profile.

**8—Amherst-Absarokee-Castner complex, 8 to 15 percent slopes.** This complex consists of strongly sloping soils on uplands and foot slopes. About 35 percent is Amherst loam, 30 percent is Absarokee clay loam, and 25 percent is Castner loam. The Amherst soils are on some of the smooth, convex ridges and some convex foot slopes. The Absarokee soils are on the smooth, uniform foot slopes. Castner soils are mainly on the convex knolls and ridges. About 10 percent of the area consists of small inclusions of Hilger and Turner soils and small areas of Rock outcrop.

Surface runoff is medium, and the hazard of erosion is moderate. The hazard of wind erosion is slight.

Soils in this complex are suited to hay and range. Capability unit VIe-1 (dryland); Amherst and Castner soils in Shallow range site, 15- to 19-inch precipitation zone, windbreak suitability group 4; Absarokee soil in Clayey range site, 15- to 19-inch precipitation zone, windbreak suitability group 3M.

## Assinniboine series

The Assinniboine series consists of deep, well drained soils that formed in material weathered from sandstone and shale. Assinniboine soils are on smooth, sloping uplands at elevations of 3,500 to 4,500 feet. Slopes are 2 to 15 percent. The native vegetation was mainly western wheatgrass, Indian ricegrass, prairie junegrass, bluebunch wheatgrass, balsamroot, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F, and the frost-free season is 110 to 120 days.

In a representative profile the surface layer is grayish brown fine sandy loam 6 inches thick. The subsoil is grayish brown and pale brown sandy clay loam 14 inches thick. The substratum to a depth of 60 inches is pale olive fine sandy loam.

Permeability is moderate, and the available water capacity is moderate. Reaction is neutral and mildly alkaline in the upper 20 inches and moderately alkaline below that depth.

Assinniboine soils are used mainly for dryland farming, for pasture, and for range.

Representative profile of Assinniboine fine sandy loam, 2 to 15 percent slopes, 100 feet north and 200 feet east of the southwest corner of sec. 18, T. 4 N., R. 22 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium platy structure that separates to weak fine granular; soft, very friable, nonsticky and nonplastic; common fine and very fine roots and pores; neutral; clear wavy boundary.

B21t—6 to 12 inches; grayish brown (2.5Y 5/2) sandy clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine angular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine and very fine roots and pores; common thin clay films on peds and lining pores; neutral; clear wavy boundary.

B22t—12 to 20 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak medium angular blocky structure; slightly hard, friable, sticky and nonplastic; few fine and very fine roots and pores; common moderately thick clay films on peds and lining pores; neutral; clear wavy boundary.

Cca—20 to 60 inches; pale olive (5Y 6/3) fine sandy loam, olive (5Y 5/3) moist; massive; soft, friable, nonsticky and nonplastic; few fine and very fine roots; strongly effervescent; moderately alkaline.

The Ap horizon is 5 to 8 inches thick. Combined thickness of the A and B horizons ranges from 18 to 25 inches. Calcareous material is at a depth of 15 to 35 inches.

**9—Assinniboine fine sandy loam, 2 to 15 percent slopes.** This gently sloping to strongly sloping soil occupies smooth foot slopes. It has the profile described as typical of the series. Included in mapping are a few areas where slopes are steeper than 15 percent. Small areas of Beenom and Rentsac soils, Rock outcrop, and soils that have a loamy fine sand or lighter colored surface layer are included. Some included soils have soft sandstone at a depth of 40 to 60 inches.

Surface runoff is slow or medium. The hazard of water and wind erosion is moderate.

This soil is suited to wheat, barley, and hay production. It is also suited to range. Capability unit IVe-1 (dryland); Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**10—Assinniboine-Rentsac complex, 6 to 12 percent slopes.** This complex consists of moderately sloping and strongly sloping soils on foot slopes and alluvial fans. About 60 percent is Assinniboine fine sandy loam and about 30 percent is Rentsac channery loam. Assinniboine fine sandy loam occupies the swales and broad foot slopes, and Rentsac channery loam occupies the steeper convex areas and sides of drainageways. Included in mapping is about 10 percent Beenom and Tanna soils. Also included are a few small areas of Rock outcrop and a few areas of a soil that is moderately deep to sandstone.

The Rentsac soil in this complex has a profile similar to that described as typical for the Rentsac series, except it has a channery loam surface layer.

Surface runoff is medium. The hazard of wind and water erosion is moderate.

Soils in this complex are suited to range. Capability unit IVe-2 (dryland); Assinniboine soil in Sandy range site, 10- to 14-inch precipitation zone, windbreak suitability group 2M; Rentsac soil in Shallow range site, 10- to 14-inch precipitation zone, windbreak suitability group 4.

## Attewan series

The Attewan series consists of deep, well drained soils that formed on alluvial terraces at an elevation of 3,000 to 3,500 feet. The soils are underlain by sand and gravel at a depth of 20 to 40 inches. Slopes are 0 to 4 percent. The native vegetation was mainly bluegrass, prairie junegrass, blue grama, basin wildrye, western wheatgrass, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F, and the frost-free season is 110 to 130 days.

In a representative profile the surface layer is grayish brown and brown loam 9 inches thick. The subsoil is brown clay loam 9 inches thick. The substratum is light brownish gray loam in the upper 10 inches overlying loose very gravelly sand.

Permeability is moderate to a depth of about 28 inches and very rapid below that. The available water capacity is very low to moderate. Reaction is neutral to a depth of 18 inches and moderately alkaline below that depth.

These soils are used mainly for irrigated crops and pasture and for range. Some small areas are used for dryland crops.

Representative profile of Attewan loam, 0 to 4 percent slopes, 800 feet east and 50 feet south of the northwest corner of sec. 27, T. 2 S., R. 23 E.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear smooth boundary.

A12—4 to 9 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear smooth boundary.

B2t—9 to 18 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and very fine roots and pores; common thin clay films on peds; neutral; clear wavy boundary.

C1ca—18 to 28 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and very fine roots; 5 percent pebbles; violently effervescent; mildly alkaline; clear wavy boundary.

IIC2—28 to 60 inches; very gravelly sand; single grained; loose; lime coatings on pebbles and cobbles; strongly effervescent; mildly alkaline.

The A horizon, where cultivated, is 6 to 8 inches thick. The reaction of the A and B horizons ranges from neutral to moderately alkaline. The B2t and C1ca horizons contain 0 to 35 percent coarse fragments that are mainly gravel, but a few cobbles are in some profiles. Depth to the loose sand and gravel ranges from 20 to 40 inches.

**11—Attewan loam, 0 to 4 percent slopes.** This gently sloping soil occupies stream terraces and fan terraces. It has the profile described as typical of the series. Included in mapping are small areas of Beaverell and Yamac soils, small areas that have steeper slopes, small areas that have a gravelly loam surface layer, and areas that have sand and gravel at a depth of 40 to 60 inches.

Surface runoff is slow to medium. The hazard of water erosion is slight or moderate and the hazard of wind erosion is slight.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation it is suited to wheat, barley, oats, corn for silage, sugar beets, and hay. Capability units IIIs-1 (dryland) and IIe-1 (irrigated); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**12—Attewan loam, seeped, 0 to 4 percent slopes.** This nearly level and gently sloping soil occupies stream terraces. It has a profile similar to that described as typical of the series except that there is a seasonal high water table at a depth of less than 20 inches during June, July, and August. The water source is irrigation seepage from canals.

Included in mapping are small areas of poorly drained soils that have a very strongly alkaline surface layer. Also included are areas that have a silty clay loam surface layer, and some areas of a soil that is more than 40 inches deep to sand and gravel.

Surface runoff is slow, and the hazards of water and wind erosion are slight.

This soil is suited to hay and range. Wheat, oats, barley, and corn for silage can be grown where water management practices lower the seasonal high water table. Capability unit IIw-1 (irrigated); Subirrigated range site; windbreak suitability group 3W.

**13—Attewan-Beaverell gravelly loams, 0 to 4 percent slopes.** This complex consists of nearly level and gently sloping soils on stream terraces. About 75 percent is Attewan gravelly loam, and about 20 percent is Beaverell gravelly loam. Attewan gravelly loam occupies the swales and lower part of the slopes. Beaverell gravelly loam occupies the convex gravel bars and terrace edges. The Beaverell soil has the profile described as typical of the Beaverell series. Included in mapping are small areas where slopes are steeper and some small areas where the depth to sand and gravel is more than 40 inches.

Surface runoff is medium, and the hazard of wind and water erosion is slight.

Soils of this complex are suited to range. Small areas are used for irrigated wheat, barley, and alfalfa hay. Capability units IIIs-1 (dryland) and IIe-1 (irrigated); Attewan soil in Silty range site, 10- to 14-inch precipitation zone, windbreak suitability group 2M; Beaverell soil in Shallow to Gravel range site, 10- to 14-inch precipitation zone, windbreak suitability group 4.

## Beaverell series

The Beaverell series consists of deep, well drained soils that formed on stream terraces. These soils are at an elevation of 3,000 to 4,500 feet and are underlain by sand and gravel at a depth of 10 to 20 inches. Slopes are 0 to 8 percent. The native vegetation was prairie junegrass, western wheatgrass, bluegrass, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F. The frost-free season is 110 to 130 days.

In a representative profile the surface layer is grayish brown very gravelly loam 6 inches thick. The subsoil is brown very gravelly loam 6 inches thick. The substratum to a depth of more than 60 inches is very gravelly coarse sand.

Permeability is moderate in the upper 12 inches and is very rapid below. The available water capacity is very low to low. Reaction is neutral to a depth of 12 inches and is moderately alkaline below that depth.

Beaverell soils are used mainly for pasture or range. Small areas are used for irrigated crops.

Representative profile of Beaverell very gravelly loam in an area of Attewan-Beaverell gravelly loams, 0 to 4 percent slopes, 1,000 feet east and 50 feet north of the southwest corner of sec. 27, T. 2 S., R. 23 E.

A1—0 to 6 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; 5 percent cobbles; 55 percent pebbles; neutral; gradual wavy boundary.

B2t—6 to 12 inches; brown (10YR 4/3) very gravelly heavy loam, very dark grayish brown (10YR 3/2) moist; weak medium blocky structure; slightly hard, friable, sticky and plastic; common thin clay films coating pebbles and peds; 5 percent cobbles; 55 percent pebbles; neutral; gradual wavy boundary.

Cca—12 to 60 inches; very gravelly coarse sand that is 10 percent cobbles and 60 percent pebbles; single grained; loose; strongly effervescent; moderately alkaline.

The combined thickness of the A and B horizons ranges from 11 to 15 inches. Depth to sand and gravel ranges from 10 to 20 inches. The coarse fragment content ranges from 30 to 70 percent in the A horizon and from 45 to 70 percent below the A horizon. The coarse fragments are generally pebbles, although some profiles contain about 50 percent cobbles.

**14—Beaverell very gravelly loam, 0 to 8 percent slopes.** This nearly level to moderately sloping soil occupies edges of stream terraces. Included in mapping are small areas in which sand and gravel are at a depth of more than 20 inches. Small areas of Yamac and Attewan soils are also included.

Surface runoff is slow or medium, and the hazard of wind and water erosion is slight.

This soil is suited mainly to range. Capability unit VIs-1 (dryland); Shallow to Gravel range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Beenom series

The Beenom series consists of shallow, well drained soils that formed in material weathered from sandstone. Beenom soils are on uplands at an elevation of 4,000 to 4,500 feet. They are underlain by bedrock at a depth of 10 to 20 inches. Slopes are 4 to 8 percent. The native vegetation was mainly western wheatgrass, bluebunch wheatgrass, green needlegrass, blue grama, annuals, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 43 to 47 degrees F. The frost-free season is 105 to 120 days.

In a representative profile the surface layer is grayish brown loam 7 inches thick. The subsoil is brown clay loam 11 inches thick. It is underlain by hard sandstone.

Permeability is moderate, and available water capacity is very low. Reaction is mildly alkaline.

Beenom soils are mainly used for dryland crops and for range.

Representative profile of Beenom loam, in an area of Tanna-Beenom complex, 4 to 8 percent slopes, 2,100 feet west, 800 feet south of the northeast corner of sec. 19, T. 4 N., R. 20 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; abrupt smooth boundary.

B21t—7 to 13 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; strong medium and fine angular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots and tubular pores; many thin clay films on peds; mildly alkaline; clear smooth boundary.

B22t—13 to 18 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure that separates to strong fine angular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots and tubular pores; many thin clay films on peds and on sandstone fragments; 5 percent sandstone channers; mildly alkaline; abrupt wavy boundary.

IIR—18 inches; hard thin platy sandstone.

Depth to bedrock ranges from 10 to 20 inches. The soil is generally noncalcareous, but some profiles have lime between 16 and 20 inches. Beenom soils are mapped only in a complex with Tanna soils.

## Birney series

The Birney series consists of deep, well drained soils that formed in colluvium or residuum from sandstone and shale. Birney soils occupy uplands at an elevation of 4,000 to 4,500 feet. Slopes are 15 to 50 percent. The native vegetation was needleandthread, bluebunch wheatgrass, sideoats grama, little bluestem, western wheatgrass, forbs, shrubs, and low density stands of ponderosa pine. The mean annual precipitation is 10 to 15 inches. The mean annual soil temperature is 45 to 47 degrees F, and the frost-free season is 105 to 130 days.

In a representative profile the surface layer is brown channery loam 4 inches thick. The subsoil is yellowish brown channery loam 10 inches thick. The substratum is pale brown very channery sandy loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is low. Reaction is moderately alkaline.

These soils are mainly used for woodland and for range.

Representative profile of Birney channery loam in an area of Birney-Yawdim-Rock outcrop association, steep, 500 feet west and 300 feet south of the northeast corner of the SE1/4 of sec. 25, T. 2 S., R. 21 E.

A1—0 to 4 inches; brown (10YR 5/3) channery loam, dark brown (10YR 4/3) moist; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 20 percent hard shale and sandstone channers; slightly effervescent; moderately alkaline; clear smooth boundary.

B2—4 to 14 inches; yellowish brown (10YR 5/4) channery loam, dark brown (10YR 4/3) moist; weak medium prismatic structure that separates to moderate fine subangular blocky; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; 40 percent hard shale and sandstone channers; slightly effervescent; moderately alkaline; clear smooth boundary.

C1ca—14 to 24 inches; pale brown (10YR 6/3) very channery sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and nonplastic; common very fine and fine roots matted around coarse fragments; common to many lime coatings on undersides of coarse fragments; 50 percent hard shale and sandstone channers; violently effervescent; moderately alkaline; gradual wavy boundary.

C2—24 to 60 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few fine roots; common to many lime coatings on undersides of coarse fragments; 60 percent hard shale and sandstone channers; moderately effervescent; moderately alkaline.

The A horizon is brown or pale brown. The A and B horizons are neutral to moderately alkaline. The coarse fragment content ranges from 40 to 75 percent in the B and C horizons.

**15—Birney-Yawdim-Rock outcrop association, steep.** This association is about 45 percent Birney channery loam that has 15 to 35 percent slopes, 20 percent Yawdim clay loam that has 15 to 50 percent slopes, and 15 percent Rock outcrop that has 15 to 50 percent slopes. The Birney soil occupies the foot slopes and sides of hills and valleys. The Yawdim soil occupies a similar position, but has steeper slopes. The Rock outcrop mostly has the steeper slopes.

Included in mapping, and making up about 20 percent of the acreage, are Yamac, Tanna, and Lambeth soils.

Surface runoff is rapid, and the hazard of water erosion is severe and of wind erosion is slight.

The soils in this association are used for woodland; mainly for grazable woodland. Ponderosa pine is the only

commercial tree growing on these soils. Rocky Mountain juniper, which grows well on them, is not considered a commercial tree.

Birney soils are well suited to the production of ponderosa pine. They are capable of producing 3,900 to 5,100 cubic feet of wood per acre, or 12,000 to 16,000 board feet of merchantable timber from a fully stocked, even-aged stand of 100-year old trees. They are expected to be 60 to 68 feet tall in 100 years (site index 60 to 68).

Woodland management considerations for the Birney soils are a moderate erosion hazard and limited use of equipment because of steep slopes and the severe seedling mortality caused by low available water capacity and the warm south aspect of some sites. The windthrow hazard and plant competition are slight.

The Yawdim soils are not so well suited to the production of ponderosa pine. They are capable of producing 3,200 to 3,650 cubic feet of wood per acre, or 5,000 to 9,500 board feet of merchantable timber, from a fully stocked, even-aged stand of 100-year old trees. They are expected to be 46 to 55 feet tall in 100 years (46 to 55 site index).

Woodland management considerations for the Yawdim soils are a severe erosion hazard caused by steep slopes and slow permeability; severe equipment limitation caused by steep slopes and clay texture; severe seedling mortality caused by very low available water capacity and the warm south aspect of some sites. The windthrow hazard is moderate because these soils are shallow. Plant competition is slight.

When harvesting trees, the shelterwood and selective silvicultural systems are well adapted.

The understory vegetation on both soils consists mainly of bluebunch wheatgrass, Idaho fescue, skunkbush sumac, Rocky Mountain juniper, snowberry, and needleandthread. Many of these plants have grazing value for cattle or wildlife.

The estimated total average annual air-dry yield of understory plants on the Birney soils is 400 pounds per acre if the canopy cover is 50 to 70 percent and 1,100 pounds per acre if the canopy is 10 to 30 percent. The air-dry yields for the Yawdim soils are 75 percent as much. An estimated 80 percent of the yields is potential forage for grazing animals.

Rock outcrop occurs throughout the unit and must be considered when harvesting timber. Use of machinery is hampered and the construction of roads can be costly in areas of Rock outcrop.

These soils must be managed to keep soil losses to a minimum, promote revegetation of desirable trees, and keep the plant understory in good condition, thereby maintaining their value for watershed, esthetic uses, wildlife, and timber production. Adequate provision must be made to safeguard the trees from fire and insect damage. Birney and Yawdim soils in capability unit VIIe-1 (dryland), windbreak suitability group 4; Rock outcrop in capability class VIII.

## Bonfri series

The Bonfri series consists of moderately deep, well drained soils that formed in material weathered from loamstone, siltstone, and clay shale. These soils are on uplands at an elevation of 3,500 to 4,000 feet. They are underlain at a depth of 20 to 40 inches by hard impermeable shale that restricts the downward movement of water and roots. Slopes are 2 to 15 percent. The native vegetation was mainly western wheatgrass, needleandthread, bluebunch wheatgrass, blue grama, green needlegrass, threadleaf sedge, prairie junegrass, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 43 to 47 degrees F, and the frost-free season is 110 to 120 days.

In a representative profile the surface layer is grayish brown loam 7 inches thick. The subsoil is grayish brown clay loam 21 inches thick. The substratum is 8 inches of light brownish gray clay loam overlying interbedded loamstone, siltstone, and clay shale.

Permeability is moderate, and the available water capacity is low to moderate. Reaction is neutral to a depth of 23 inches and moderately alkaline below that depth.

Bonfri soils are used for wheat, barley, and oats and for pasture and range.

Representative profile of Bonfri loam in an area of Bonfri-Lambeth complex, 8 to 15 percent slopes, 200 feet west and 80 feet north of the southeast corner of sec. 12, T. 2 S., R. 20 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; neutral; clear wavy boundary.

B2t—7 to 23 inches; grayish brown (10YR 5/2) clay loam, brown (10YR 4/3) moist; weak medium prismatic structure that separates to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; few fine and very fine roots and pores; few thin discontinuous clay films; neutral; gradual wavy boundary.

B3ca—23 to 28 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine prismatic structure; slightly hard, friable, sticky and plastic; few very fine roots and pores; many lime segregations in threads and seams; one percent sandstone channers that are lime coated; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—28 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; few very fine roots and common pores; 5 percent shale fragments; common distinct white (2.5Y 8/2) lime segregations in seams and lime-coated shale fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2r—36 to 60 inches; olive (5Y 5/3) soft interbedded loamstone, siltstone, and clay shale.

Depth to shale ranges from 20 to 40 inches. Depth to segregated lime ranges from 20 to 30 inches.

**16—Bonfri-Lambeth complex, 2 to 8 percent slopes.** This complex consists of gently sloping to moderately sloping soils. About 50 percent is Bonfri loam, and about 35 percent is Lambeth silt loam. Bonfri loam occupies the swales and lower parts of the slopes. Lambeth silt loam occupies the upper part of the slopes and the convex

areas. Included in mapping, and making up about 15 percent of the acreage, are Beenom and Lonna soils.

Surface runoff is medium, and the hazard of wind and water erosion is moderate.

Soils in this complex are suited to wheat, barley, oats, hay, and range. Capability unit IIIe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; Bonfri soil in windbreak suitability group 3M and Lambeth soil in group 1.

**17—Bonfri-Lambeth complex, 8 to 15 percent slopes.** This complex consists of strongly sloping soils. About 60 percent is Bonfri loam, and about 30 percent is Lambeth silt loam. Bonfri loam occupies the swales and lower parts of the slopes. Lambeth silt loam occupies the upper part of the slopes and the convex areas. Included in mapping, and making up about 10 percent of the acreage, are Beenom and Lonna soils. The Bonfri soil in this complex has the profile described as typical for the series.

Surface runoff is medium. The wind erosion hazard is moderate, and the water erosion hazard is moderate or severe.

Soils in this complex are suited to wheat, barley, oats, hay, and range. Capability unit IVe-2 (dryland), Silty range site, 10- to 14-inch precipitation zone; Bonfri soil in windbreak suitability group 3M and Lambeth soil in group 1.

## Cabba series

The Cabba series consists of shallow, well drained soils that formed in material weathered from soft sandstone and shale. Cabba soils are on uplands at an elevation of 4,000 to 5,000 feet. They are underlain at a depth of 10 to 20 inches by soft sandstone or shale that is impermeable and restricts the downward movement of water and roots. Slopes are 4 to 10 percent. The native vegetation was needleandthread, bluebunch wheatgrass, western wheatgrass, blue grama, annuals, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 42 to 47 degrees F. The frost-free season is 90 to 100 days.

In a representative profile the surface layer is grayish brown clay loam 5 inches thick. The underlying material is 10 inches of light brownish gray clay loam overlying light gray and olive shale.

Permeability is moderate. The available water capacity is very low. Reaction is moderately alkaline.

Cabba soils are mainly used for range. Some areas are used for small grain, hay, and pasture.

Representative profile of Cabba clay loam in an area of Shane-Cabba clay loams, 4 to 10 percent slopes, under native grass, 400 feet south and 800 feet east of the northwest corner of sec. 34, T. 3 S., R. 20 E.

A1—0 to 5 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—5 to 15 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C2ca—15 to 18 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; in strata 1/4 to 1/8 inch thick; hard, friable, sticky and plastic; common fine and very fine roots and pores; violently effervescent; moderately alkaline; gradual smooth boundary.

C3r—18 to 60 inches; olive (5Y 5/4) shale, with interbedded strata of siltstone and fine sandstone; mottled with pale olive (5Y 6/3), white (5Y 8/2), light olive gray (5Y 6/2), and olive yellow (5Y 6/6); few fine and medium roots mainly along vertical cracks and along horizontal bedding planes.

Depth to bedrock ranges from 10 to 20 inches. Cabba soils are mapped only in a complex with Shane soils.

## Castner series

The Castner series consists of shallow, well drained soils that formed in material weathered from sandstone. Castner soils are on uplands at an elevation of 3,400 to 5,000 feet and are underlain by bedrock at a depth of 10 to 20 inches. Slopes are 8 to 60 percent. The native vegetation was bluebunch wheatgrass, rough fescue, Idaho fescue, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 45 to 47 degrees F. The frost-free season is 90 to 110 days.

In a representative profile the surface layer is dark grayish brown and brown loam 10 inches thick. The underlying material is light gray very channery loam 8 inches thick. It overlies hard sandstone.

Permeability is moderate, and the available water capacity is very low. Reaction is neutral to a depth of 10 inches and moderately alkaline below that depth.

These soils are mainly used for range and wildlife.

Representative profile of Castner loam in an area of Absarokee-Amherst-Castner complex, 4 to 8 percent slopes, 200 feet east and 1,100 feet south of the west quarter corner of section 28, T. 4 S., R. 19 E.

A11—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; neutral; gradual wavy boundary.

A12—7 to 10 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium angular blocky structure that separates to moderate fine granular; soft, friable, nonsticky and nonplastic; many fine and very fine roots and pores; neutral; clear wavy boundary.

IICca—10 to 18 inches; light gray (10YR 7/2) very channery loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine and very fine roots and pores; 60 percent sandstone channers; few pockets of lime, and lime coatings on undersides of sandstone fragments; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIR—18 inches; gray hard sandstone.

Depth to bedrock ranges from 10 to 20 inches.

Castner soils are mapped only in a complex or an association with Absarokee, Amherst, Hilger, and Wayden soils and Rock outcrop.

## Cheadle series

The Cheadle series consists of shallow, well drained soils that formed in material weathered from sandstone. Cheadle soils are on foot slopes at an elevation of 5,000 to 6,000 feet. They are underlain by igneous or sandstone bedrock at a depth of 10 to 20 inches. Slopes are 25 to 75 percent. The native vegetation was Idaho fescue, western wheatgrass, bluebunch wheatgrass, rough fescue, spike fescue, green needlegrass, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 40 to 42 degrees F, and the frost-free season is 60 to 90 days.

In a representative profile the surface layer is very dark grayish brown and dark brown channery and very channery loam 9 inches thick. The underlying material is fractured sandstone, and it overlies hard sandstone.

Permeability is moderate, and the available water capacity is very low. Reaction is mildly alkaline and moderately alkaline.

These soils are mainly used for range.

Representative profile of Cheadle channery loam in native grass, in an area of Sebud-Cheadle association, very steep, 1,200 feet east and 100 feet north of the southwest corner of sec. 12, T. 5 S., R. 15 E.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) channery loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; 20 percent sandstone channers; mildly alkaline; clear wavy boundary.

A12—4 to 9 inches; dark brown (10YR 4/3) very channery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; roots somewhat matted between plates of sandstone; few fine pores; 50 percent channers and 10 percent flagstones; moderately alkaline; abrupt wavy boundary.

Crca—9 to 12 inches; fractured hard sandstone with lime coatings on undersides of flagstones; fine roots follow fractures and are matted between layers of sandstone; clear wavy boundary.

R—12 inches; hard sandstone.

Depth to bedrock ranges from 10 to 20 inches. Lime occurs as hardened crusts on undersides of flagstones at a depth of 9 to 12 inches.

Cheadle soils are mapped only in an association with Sebud soils.

## Garlet series

The Garlet series consists of deep, well drained soils that formed in colluvium or residuum from sandstone or various igneous rocks. These soils are on the mountainsides and foot slopes at an elevation of 4,500 to 6,000 feet. Slopes are 25 to 75 percent. Native vegetation was mainly Douglas-fir and lodgepole pine, pinegrass, snowberry, ninebark, Richardson's needlegrass, purple reedgrass, bluebunch wheatgrass, and Idaho fescue. The mean annual precipitation is 19 to 24 inches. The mean annual soil temperature is 38 to 44 degrees F. The frost-free season is 60 to 90 days.

In a representative profile the surface layer is light brownish gray gravelly sandy loam 12 inches thick. The subsoil is pale brown gravelly sandy loam and cobbly loam to a depth of 60 inches or more.

Permeability is moderately rapid, and the available water capacity is low. Reaction is neutral throughout.

These soils are used mainly as woodland.

Representative profile of Garlet gravelly sandy loam in an area of Garlet-Sebud association, very steep, under trees, 1,980 feet east and 600 feet north of SE corner of sec. 19, T. 3 S., R. 16 E.

O1—1 inch to 0; forest duff.

A2—0 to 12 inches; light brownish gray (10YR 6/2) gravelly sandy loam; dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; common fine pores; very dark grayish brown (10YR 3/2) organic coatings on peds and as pockets; 15 percent pebbles; neutral; clear wavy boundary.

B21—12 to 53 inches; pale brown (10YR 6/3) gravelly sandy loam, grayish brown (2.5Y 5/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine tubular pores; 35 percent pebbles and 5 percent cobbles; neutral; gradual smooth boundary.

B22—53 to 60 inches; pale brown (10YR 6/3) very cobbly loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; common fine tubular pores; 50 percent cobbles; neutral.

The surface layer is light brownish gray or grayish brown. Some profiles have a very pale brown A2 horizon.

**18—Garlet-Sebud association, very steep.** This association consists of about 55 percent Garlet gravelly sandy loam and 35 percent Sebud stony loam. It occurs on ridges and mountainsides and has slopes of 25 to 60 percent. Garlet soils are mainly forested, and the Sebud soils are mainly grassland. Included in mapping is about 10 percent Cheadle soils and Rock outcrop and soils that have bedrock at a depth of 20 to 40 inches.

Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

This association is used for timber production, watershed, and wildlife. Some of the Sebud soils are also used for range. Low yield stands of quaking aspen grow on the Sebud soils at low elevations.

Garlet and Sebud soils have similar production and are well suited to production of Douglas-fir and lodgepole pine. Lodgepole pine is the most common tree. These soils are capable of producing 4,800 to 7,600 cubic feet of wood per acre, or 10,000 to 18,500 board feet of merchantable timber from a fully stocked, even-aged stand of 100-year-old lodgepole pine.

When harvesting trees, the clearcut seed-tree, shelterwood, and selective silvicultural systems are adapted. The clearcut system can be used to favor the regeneration of lodgepole pine. Both lodgepole pine and Douglas-fir are suitable trees for planting.

The major limiting soil feature in the production or harvest of timber is the steep slopes. The steep slopes present a moderate equipment limitation and prevent the use of smaller equipment except on roads and in yards. Special attention must be given to keeping soil losses to a minimum during harvest because of the moderate erosion hazard. The seedling mortality rate is moderate because of the low available water capacity, and the plant com-

petition is severe because of the highly competitive understory vegetation.

The yield of the understory plants is estimated to be 2,000 pounds per acre where there is a 10 to 30 percent crown cover and 625 pounds per acre where there is a 50 to 70 percent crown cover. Some of the main understory plants that have high grazing value for cattle, deer, and elk are elk sedge, common snowberry, and serviceberry.

These soils must be managed to keep soil erosion to a minimum, promote revegetation of desirable trees, and keep the plant understory in good condition. The trees must be safeguarded from harmful insects and from fire if the area's value for watershed, esthetic uses, wildlife, rangeland, and timber production is to be maintained. Capability unit VIIe-1.

## Glendive series

The Glendive series consists of deep, well drained soils that formed in alluvium. Glendive soils are on flood plains and low stream terraces at an elevation of 3,000 to 3,500 feet. Slopes are 0 to 4 percent. The native vegetation was mainly bluegrass, western wheatgrass, green needlegrass, prairie junegrass, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F, and the frost-free season is 110 to 130 days.

In a representative profile the surface layer is light brownish gray fine sandy loam 6 inches thick. The underlying material is light brownish gray stratified sandy loam.

Permeability is moderately rapid to a depth of 60 inches. The available water capacity is moderate. Reaction is mildly alkaline to a depth of 6 inches and strongly alkaline below that depth.

Glendive soils are used mainly for dryland and irrigated crops, for pasture, for range, and for wildlife.

Representative profile of Glendive fine sandy loam, 0 to 4 percent slopes, 1,600 feet west and 200 feet north of the southeast corner of section 25, T. 2 S., R. 22 E.

A1—0 to 6 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; slightly effervescent; mildly alkaline; clear smooth boundary.

C—6 to 60 inches; light brownish gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) moist; massive; soft, friable, nonsticky and nonplastic; 1/2 to 1 inch thick silt loam, loamy fine sand, and clay strata; few fine and medium roots and pores; few seams and threads of lime; strongly effervescent; strongly alkaline.

Depth to stratified material ranges from 5 to 7 inches. Some profiles have lenses of gravel in the C horizon.

**19—Glendive fine sandy loam, 0 to 4 percent slopes.** This nearly level and gently sloping soil occupies stream terraces and alluvial fans. It has the profile described as typical for the series. Included in mapping are a few small areas that have a silt loam surface layer and fine sandy loam underlying material. Small areas of Yamac and Havre soils are also included.

Surface runoff is slow, and the hazard of water and wind erosion is moderate.

This soil is suited to hay and barley under dryfarm management. With irrigation, it is also suited to hay, oats, wheat, sugar beets, and corn for silage. It is also well suited to range. Capability units IVe-2 (dryland) and IIe-2 (irrigated); Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**20—Glendive fine sandy loam, occasionally flooded.** This nearly level soil occupies the low stream terraces and flood plains adjacent to the Yellowstone River. It is occasionally flooded early in spring when ice jams form in the river and during peak periods of runoff from snowmelt.

Included in mapping are small areas of gravel, deep channels, areas where the surface layer is loam or clay loam, and some places where sand and gravel are at a depth of 10 to 40 inches. In some places a seasonal water table is within 40 inches of the surface because of irrigation. Also included are small areas of Harlem and Havre soils.

Surface runoff is slow. The hazard of water erosion is slight to severe and of wind erosion is moderate.

This soil is suited to barley, oats, and hay production under dryfarm management and to sugar beets, corn for silage, wheat, barley, oats, and hay under irrigation. To a lesser extent, it is suitable for timber production.

This Glendive soil supports mainly plains cottonwood and some understory of boxelder trees. It produces 18,000 to 27,000 board feet, or 3,500 to 5,200 cubic feet, per acre of merchantable timber from a fully stocked, even-aged stand of 70-year old trees. The trees are expected to be 70 to 80 feet tall in 30 years (site index 70 to 80).

Harvesting trees by clearcutting in small patches favors the regeneration of plains cottonwood over boxelder, because the cottonwoods do not tolerate much shade and plant competition.

The erosion hazard, equipment limitation, seedling mortality, and windthrow hazard are slight. The plant competition is moderate because stands of understory vegetation are dense and tolerate few seedlings.

A relatively competition-free site is needed for good seedling survival and rapid plant regeneration. Obtaining adequate natural regeneration may be difficult, because cottonwood requires a continuously moist mineral soil seedbed for adequate seed germination and seedling growth. Capability units IVw-1 (dryland) and IIw-2 (irrigated); Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

## Grail series

The Grail series consists of deep, well drained soils that formed in alluvium. Grail soils are on foot slopes, alluvial fans, and stream terraces at an elevation of 3,500 to 5,000 feet. Slopes are 2 to 8 percent. The native vegetation was bluegrass, rough fescue, spike fescue, thickspike, cordgrass, annuals, and woody plants. The mean annual

precipitation is 15 to 19 inches. The mean annual soil temperature is 42 to 47 degrees F, and the frost-free season is 90 to 110 days.

In a representative profile the surface layer is dark grayish brown clay loam 13 inches thick. The subsoil is grayish brown clay loam 12 inches thick. The substratum is light brownish gray silty clay loam.

Permeability is moderately slow. The available water capacity is high. Reaction is neutral to a depth of 25 inches and is moderately alkaline below that depth.

These soils are used mainly for dryland and irrigated crops of small grains and hay and for pasture and range.

Representative profile of Grail clay loam, 0 to 4 percent slopes, 1,800 feet north and 2,100 feet east of the southwest corner of sec. 20, T. 3 S., R. 19 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak fine angular blocky structure separating to fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots and common fine and very fine pores; neutral; clear wavy boundary.

A12—6 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure that separates to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; common fine and very fine roots and pores; neutral; clear wavy boundary.

B2t—13 to 25 inches; grayish brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure that separates to strong medium and fine angular blocky; hard, firm, sticky and plastic; few fine and very fine roots and tubular pores; common thin clay films on peds; neutral; clear wavy boundary.

Cca—25 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, sticky and plastic; few fine and very fine roots and pores; few small pockets, seams and threads of lime; strongly effervescent; moderately alkaline.

The A horizon is 12 to 15 inches thick. The combined thickness of the A and B horizons ranges from 20 to 40 inches. Some profiles have thin lenses of gravel, and some have 5 to 15 percent coarse fragments throughout.

**21—Grail clay loam, 0 to 4 percent slopes.** This nearly level and gently sloping soil occupies low stream terraces and alluvial fans. It has the profile described as typical of the series.

Included in mapping are a few small areas that have a silty clay loam surface layer and a clay loam subsoil. Small areas of Lolo, Turner, and Lohler soils are also included. Along the Stillwater River and its tributaries there are soils that have cobbles and stones on the surface and, in places, throughout the profile. These areas are more difficult to cultivate and are used mainly for hay and pasture.

Surface runoff is slow. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is also suited to wheat, barley, oats, and hay under irrigation. It is suited to range. Capability units IIIe-3 (dryland) and IIe-3 (irrigated); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**22—Grail clay loam, 4 to 8 percent slopes.** This moderately sloping soil occupies alluvial fans and foot slopes along valley sides.

Included in mapping are a few small areas of soils that have slopes of more than 8 percent or less than 4 percent and some areas that have a silty clay loam surface layer. Small areas of Work and Lohler soils are also included and along the Stillwater River and its tributaries there are soils that have cobbles and stones on the surface, and in places, throughout the profile. These areas are more difficult to cultivate and are mainly used for hay and pasture.

Surface runoff is medium, and the hazard of wind and water erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is also suited to wheat, oats, and hay. It is suited to range. Capability units IIIe-3 (dryland) and IIIe-1 (irrigated); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Harlem series

The Harlem series consists of deep, well drained soils that formed in alluvium. Harlem soils are on alluvial fans and stream terraces at an elevation of 3,000 to 4,500 feet. Slopes are 0 to 4 percent. The native vegetation was mainly western wheatgrass, bluegrasses, rough fescue, sedges, bromegrass, and deciduous and evergreen trees. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 43 to 47 degrees F, and the frost-free season is 105 to 130 days.

In a representative profile the surface layer is dark grayish brown clay loam 4 inches thick. The underlying material is 5 inches of grayish brown clay loam over brown and olive gray clay that extends to a depth of 60 inches or more.

Permeability is slow. The available water capacity is high. Reaction is neutral to a depth of 16 inches, and it is moderately alkaline below that depth.

Harlem soils are used mainly for irrigated crops and pasture. Some areas are used for dryfarming and for range.

Representative profile of Harlem clay loam, 0 to 2 percent slopes, 1,800 feet west and 100 feet south of the northeast corner of sec. 31, T. 1 S., R. 18 E.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and thin platy structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and pores; neutral; clear wavy boundary.

C1—4 to 9 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse granular structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and pores; neutral; abrupt wavy boundary.

C2—9 to 16 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; hard, firm, very sticky and plastic; many fine and very fine roots and pores; neutral; clear wavy boundary.

C3—16 to 60 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; hard, firm, sticky and plastic; few very fine roots and

pores; many fine distinct lime seams and threads; strongly effervescent; moderately alkaline.

The Ap horizon is 2 to 6 inches thick. The A and C horizons are neutral to mildly alkaline to a depth of 16 inches. Some profiles have thin lenses of silt loam and loam.

**23—Harlem clay loam, 0 to 2 percent slopes.** This nearly level soil occupies terraces, alluvial fans, and flood plains. It has the profile described as typical of the series.

Included in mapping are a few small areas that have a silty clay loam surface layer and clay or clay loam underlying material. Small areas of Havre soils are also included. In some small areas, mostly adjacent to the larger rivers, sand and gravel are at a depth of 20 to 40 inches.

Surface runoff is slow, and the hazard of wind and water erosion is slight.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is suited to corn silage, wheat, barley, oats, and hay. It is also well suited to range. Capability units IIs-1 (irrigated) and IIIs-2 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**24—Harlem clay loam, occasionally flooded.** This nearly level soil is on flood plains mainly near the Yellowstone River. It is subject to flooding, mainly during the winter when the ice jams melt and in the spring and early summer from snowmelt.

Included in mapping are small areas of Havre soils. In some small areas, mostly adjacent to the river, sand and gravel are at a depth of 20 to 40 inches.

Surface runoff is slow. The hazard of wind erosion is slight, and of water erosion is slight to severe. This soil is subject to scouring where the current of the overflow water concentrates.

If irrigated, this soil is suited to wheat, barley, corn for silage, and hay production. Under dryland farming the major crops are wheat, barley, and hay. This soil is suited to range. Capability units IIw-2 (irrigated) and IIIw-1 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Havre series

The Havre series consists of deep, well drained soils that formed in alluvium. Havre soils are on low stream terraces, flood plains, and alluvial fans at elevations of 3,000 to 3,500 feet. Slopes are 0 to 4 percent. The native vegetation was mainly western wheatgrass, green needlegrass, prairie junegrass, blue grama, bluegrass, forbs, shrubs, and deciduous and evergreen trees. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F, and the frost-free season is 105 to 130 days.

In a representative profile the surface layer is light brownish gray loam 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray loam over light gray stratified silt loam, very fine sandy loam, and clay.

Permeability is moderate. The available water capacity is high. Reaction is moderately alkaline to a depth of 9 inches and strongly alkaline to a depth of 48 inches.

Havre soils are mainly used for irrigated crops and for pasture. Some areas are used for dryland crops and for range.

Representative profile of Havre loam, 0 to 2 percent slopes, 3,000 feet east and 1,400 feet north of the southwest corner of section 11, T. 2 S., R. 19 E.

Ap—0 to 6 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak thin platy structure that separates to weak fine granular; soft, friable, nonsticky and nonplastic; few fine and very fine roots and pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—6 to 9 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak fine angular blocky structure that separates to weak granular; soft, friable, nonsticky and nonplastic; few very fine roots and pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—9 to 48 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots and pores; strongly effervescent; strongly alkaline; clear smooth boundary.

C3—48 to 60 inches; light gray (10YR 7/1) stratified silt loam, fine sandy loam, and clay, gray (10YR 5/1) moist; massive; soft, friable, sticky and plastic; 5 percent lime-coated pebbles.

The Ap horizon is 4 to 8 inches thick. Reaction ranges from mildly alkaline to strongly alkaline. In some profiles the C horizon has thin lenses of sand.

**25—Havre loam, 0 to 2 percent slopes.** This nearly level soil occupies low stream terraces and flood plains. It has the profile described as typical of the series.

Included in mapping are small areas of Harlem and Glendive soils. In some places there is sand and gravel at a depth of 20 to 40 inches. Also included are small areas that have a silt loam or silty clay loam surface layer. Areas along the Stillwater River receive more moisture than is typical for the Havre soils.

Surface runoff is slow. The hazard of water and wind erosion is slight.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is suited to wheat, barley, oats, corn for silage, sugar beets, and hay. It is also suited to range. Capability units IIIc-1 (dryland) and IIc-1 (irrigated); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**26—Havre loam, 2 to 4 percent slopes.** This gently sloping soil occupies stream terraces and alluvial fans. It has a profile similar to that described as typical of the series, except that it occupies more sloping landscapes.

Included in mapping are a few small areas that are less sloping or steeper. Also included are small areas that have a silt loam or silty clay loam surface layer. Small areas of Harlem and Glendive soils are also included. Areas along the Stillwater River receive more moisture than is typical for the series.

Surface runoff is medium, and the hazard of wind and water erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is suited to growing wheat, barley, oats, corn for silage, sugar beets, and hay. It is also suited to range. Capability units IIIe-2 (dryland) and IIe-4 (irrigated); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**27—Havre loam, occasionally flooded.** This nearly level soil is on flood plains mainly along the Yellowstone River. It is subject to occasional flooding, mainly during the winter as a result of ice jams and in the spring and early summer as a result of snowmelt. Included are small areas of Glendive and Harlem soils.

Surface runoff is slow. The hazard of wind erosion is moderate, and the hazard of water erosion is slight. This soil is subject to channeling when flooding occurs.

This soil is suited to wheat, oats, barley, and hay production under dryfarm management. Under irrigation, it is suited to wheat, barley, oats, and hay. It is also suited to range. Capability units IIIw-1 (dryland) and IIw-2 (irrigated); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Hilger series

The Hilger series consists of deep, well drained soils that formed in colluvium or residuum of weathered sandstone, shale, or granite. These soils are on uplands at an elevation of 3,400 to 5,000 feet. Slopes are 25 to 60 percent. The native vegetation was mainly bluebunch wheatgrass, Idaho fescue, western wheatgrass, forbs, and shrubs. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 45 to 57 degrees F, and the frost-free season is 90 to 110 days.

In a representative profile the surface layer is brown cobbly sandy loam 4 inches thick. The subsoil is brown and pale brown very cobbly sandy clay loam 20 inches thick. The substratum is brown very cobbly loam.

Permeability is moderate. The available water capacity is low. Reaction is neutral to a depth of 24 inches and mildly alkaline below that depth.

These soils are used mainly for range, but some areas are wooded.

Representative profile of Hilger cobbly sandy loam in an area of Hilger-Castner-Rock outcrop complex, 25 to 60 percent slopes, 1,500 feet west and 400 feet south of the NE corner of section 23, T. 3 S., R. 16 E.

A1—0 to 4 inches; brown (10YR 4/3) cobbly sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and few medium roots; common very fine and fine pores; 20 percent cobbles and 15 percent pebbles; neutral; clear smooth boundary.

B2t—4 to 14 inches; brown (10YR 4/3) very cobbly sandy clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; common fine tubular pores; thin discontinuous clay films on peds and lining pores; 30 percent cobbles and 20 percent pebbles; neutral; clear wavy boundary.

B3—14 to 24 inches; pale brown (10YR 6/3) very cobbly sandy clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common to many fine and medium pores; few patchy clay films lining pores; 40 percent cobbles and 20 percent pebbles; neutral; gradual smooth boundary.

C—24 to 60 inches; brown (10YR 5/3) very cobbly loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine pores; 20 percent stones; 30 percent cobbles and 10 percent pebbles; slightly effervescent; mildly alkaline.

The subsoil is sandy clay loam, loam, or clay loam and has rock fragments that make it very gravelly, cobbly, or stony. The substratum contains 50 to 80 percent rock fragments.

**28—Hilger-Castner-Rock outcrop complex, 25 to 60 percent slopes.** This complex consists of steep and very steep soils on foot slopes, ridges, and hills. Hilger cobbly sandy loam makes up about 45 percent of the unit and is on foot slopes. Castner stony loam is on ridgetops, crests of hills, and the upper part of the foot slopes, and it makes up about 30 percent of the unit. Rock outcrop makes up about 15 percent and occupies the barren areas and crests of the ridges. Included in mapping are small areas of Absarokee and Sinnigam soils. These make up about 10 percent of the acreage.

Surface runoff is rapid. The hazard of water erosion is severe and the hazard of wind erosion is slight.

These soils are mainly suited to range and wildlife. Capability unit VIIe-1 (dryland); windbreak suitability group 4; Hilger soil in Silty range site, 15- to 19-inch precipitation zone, and Castner soil in Shallow range site, 15- to 19-inch precipitation zone; Rock outcrop not assigned to a windbreak group or range site.

## Kobar series

The Kobar series consists of deep, well drained soils that formed in alluvium derived from shale. These soils are on upland foot slopes, alluvial fans, and terraces at an elevation of 3,000 to 4,000 feet. Slopes are 0 to 8 percent. The native vegetation was mainly western wheatgrass, green needlegrass, threadleaf sedge, prairie junegrass, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F, and the frost-free season is 110 to 130 days.

In a representative profile the surface layer is light brownish gray clay loam 5 inches thick. The subsoil is grayish brown silty clay loam and silty clay 23 inches thick. The substratum is grayish brown clay to a depth of 60 inches or more.

Permeability is moderately slow, and the available water capacity is high. Reaction is mildly alkaline to a depth of 28 inches and moderately alkaline below that depth.

These soils are used mainly for dryland crops, pasture, and range. Some areas are used for irrigated crops.

Representative profile of Kobar clay loam, 0 to 4 percent slopes, 1,400 feet north and 100 feet east of the southwest corner of section 27, T. 2 S., R. 23 E.

Ap—0 to 5 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium platy structure that separates to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots and pores; mildly alkaline; abrupt smooth boundary.

B21—5 to 14 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine angular blocky structure; hard, firm, sticky and plastic; many very fine roots and pores; mildly alkaline; clear wavy boundary.

B22—14 to 28 inches; grayish brown (10YR 5/2) light silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure that separates to strong medium and fine angular blocky; very hard, firm, sticky and plastic; common very fine roots and pores; mildly alkaline; clear wavy boundary.

C1ca—28 to 40 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure that separates to strong medium blocky; hard, firm, sticky and plastic; common very fine roots and pores; common nodules of segregated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2sa—40 to 60 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; extremely hard, very firm, sticky and plastic; few very fine roots and pores; common threads of segregated lime and gypsum crystals in lower part of horizon; strongly effervescent; moderately alkaline.

The Ap horizon ranges from 3 to 6 inches thick. The B2 horizon is heavy silty clay loam, silty clay, or clay.

**29—Kobar clay loam, 0 to 4 percent slopes.** This is a nearly level to gently sloping soil on foot slopes, alluvial fans, and stream terraces. It has the profile described as typical of the series.

Included in mapping are a few areas of soils that have a silty clay loam surface layer and subsoil. Also included are a few small areas where slopes are greater than 4 percent and small areas of Yamac soils.

Surface runoff is slow or medium. The hazard of wind erosion is moderate, and the hazard of water erosion is slight or moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is suited to sugar beets, corn for silage, wheat, barley, oats, and hay. It is also suited to range. Capability units IIe-3 (irrigated) and IIIe-3 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**30—Kobar clay loam, 4 to 8 percent slopes.** This is a moderately sloping soil on upland foot slopes and alluvial fans. Included in mapping are a few areas of soils that have steeper slopes and a surface layer of silty clay loam. Also included are small areas of Yamac soils.

Surface runoff is medium, and hazard of water and wind erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is suited to corn silage, sugar beets, barley, oats, wheat, and hay. It is also suited to range. Capability units IIIe-1 (irrigated) and IIIe-3 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Lambeth series

The Lambeth series consists of deep, well drained soils that formed in alluvium and material weathered from soft siltstone. They are on foot slopes, uplands, and alluvial fans at an elevation of 3,500 to 4,500 feet. Slopes are 2 to 50 percent. The native vegetation was western wheatgrass, needleandthread, green needlegrass, blue grama, threadleaf sedge, prairie junegrass, annuals, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F, and the frost-free season is 105 to 130 days.

In a representative profile the surface layer is light brownish gray silt loam 8 inches thick. The underlying material is light gray and light brownish gray silt loam that extends to a depth of 60 inches or more.

Permeability is moderately slow, and the available water capacity is high. Reaction is moderately alkaline throughout the profile.

Lambeth soils are mainly used for dryland crops and for range.

Representative profile of Lambeth silt loam, 2 to 15 percent slopes, 2,600 feet west and 400 feet north of the southeast corner of section 35, T. 4 N., R. 20 E.

Ap—0 to 8 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium platy structure that separates to strong fine granular; soft, friable, nonsticky and nonplastic; many fine and very fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C1—8 to 18 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots and pores; many fine segregations of white (10YR 8/2) lime in soft masses; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—18 to 50 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots and pores; disseminated lime and gypsum; strongly effervescent; moderately alkaline; gradual wavy boundary.

C3—50 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; strongly effervescent; moderately alkaline.

The A horizon ranges from mildly alkaline to moderately alkaline. The C horizon has few to common threads and nodules of gypsum and lime.

**31—Lambeth silt loam, 2 to 15 percent slopes.** This gently sloping to strongly sloping soil is on foot slopes and alluvial fans. It has the profile described as typical of the series. Included in mapping are a few small areas of soils that have a loam surface layer and silt loam subsoil. Small areas of Yamac, Lonna, and Rentsac soils and Rock outcrop are also included.

Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is also suited to range. Capability unit IVe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**32—Lambeth-Rentsac complex, 4 to 15 percent slopes.** This complex consists of moderately sloping and strongly sloping soils on foot slopes and alluvial fans.

About 65 percent is Lambeth silt loam and about 20 percent is Rentsac loam. Lambeth silt loam is in swales and on the lower part of foot slopes, and Rentsac loam is on convex ridges and breaks. Included in mapping and making up about 15 percent of the acreage are Yamac and Wayden soils.

Surface runoff is medium, and the hazard of wind and water erosion is moderate.

Soils in this complex are suited to wheat, barley, oats, and range. Capability unit IVe-2 (dryland); Lambeth soil in Silty range site, 10- to 14-inch precipitation zone, and windbreak suitability group 1; Rentsac soil in Shallow range site, 10- to 14-inch precipitation zone, and windbreak suitability group 4.

**33—Lambeth-Yawdim complex, 4 to 15 percent slopes.** This complex consists of moderately sloping and strongly sloping soils on foot slopes and hillsides. About 65 percent is Lambeth silt loam, and about 30 percent is Yawdim clay loam. Lambeth soils are on the lower foot slopes and swales, and Yawdim soils are on the upper slopes and convex ridges. Included in mapping and making up about 5 percent of the acreage are Yamac and Rentsac soils. Also included are soils that have a loam and very fine sandy loam surface layer.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Soils in this complex are suited to range. The less sloping soils are suited to wheat, barley, oats, and hay production under dryfarm management. Capability unit IVe-2 (dryland), Lambeth soil in Silty range site, 10- to 14-inch precipitation zone, and windbreak suitability group 1; Yawdim soil in Shallow Clay range site, 10- to 14-inch precipitation zone and windbreak suitability group 4.

## Lardell series

The Lardell series consists of deep, somewhat poorly drained soils that formed in alluvium derived from shale. The soils are on alluvial fans and in basins at an elevation of 3,500 to 4,500 feet. Slopes are 0 to 2 percent. The native vegetation was mainly saltgrasses, alkali sacaton, kochia, western wheatgrass, greasewood, fringed sagewort, junegrass, annual forbs, and other woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 42 to 47 degrees F, and the frost-free season is 110 to 120 days.

In a representative profile the surface layer is light brownish gray clay loam 7 inches thick. The underlying material is grayish brown clay loam and olive silty clay loam to a depth of 60 inches or more.

Permeability is slow, and the available water capacity is moderate. Reaction is moderately alkaline to a depth of 7 inches and very strongly alkaline below that depth.

These soils are mainly used for range. Some small areas are used for hay and pasture.

Representative profile of Lardell clay loam, 0 to 2 percent slopes, 1,000 feet east and 200 feet north of the southwest corner of section 31, T. 3 N., R. 21 E.

A1sa—0 to 7 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong thick platy structure that separates to weak medium and fine granular; hard, friable, sticky and plastic; common fine and very fine roots; common fine salt crystals; many fine pores; moderately alkaline; abrupt irregular boundary.

C1sa—7 to 17 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure that separates to weak medium and fine granular; hard, firm, sticky and plastic; common very fine roots; many very fine pores; many fine salt crystals; very strongly alkaline; clear smooth boundary.

C2sa—17 to 24 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few very fine roots; disseminated fine gypsum crystals and salt crystals; strongly effervescent; very strongly alkaline; gradual smooth boundary.

C3sa—24 to 60 inches; olive (5Y 4/3) and pale olive (5Y 6/3) moist; silty clay loam; massive; hard, firm, sticky and plastic; common disseminated lime; many coarse gypsum and salt crystals in pockets; strongly effervescent; very strongly alkaline.

The A horizon has few to many salt crystals. Some profiles have a white soft vesicular surface crust. In cultivated areas, the Ap horizon is 5 to 9 inches thick. The A horizon is mildly alkaline to strongly alkaline.

Some profiles have thin lenses of segregated salt crystals, and some have faint to distinct mottles. The C1 horizon is loam, clay loam, or silty clay loam, and in places has thin lenses of coarser or finer texture.

**34—Lardell clay loam, 0 to 2 percent slopes.** This nearly level soil occupies low areas adjacent to drainageways and large swales and depressions. It has an apparent water table between depths of 1 and 5 feet from May through August. It is strongly saline, and salt crusts are common on the surface. Vegetation is sparse and is dominantly saltgrass. Included in mapping are small areas of McKenzie and Absher soils.

Surface runoff is slow, and the hazard of wind and water erosion is slight.

This soil is suited to limited use as range. Capability unit VIIs-1 (dryland); Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Lohler series

The Lohler series consists of deep, well drained soils on flood plains, alluvial fans, and stream terraces at an elevation of 3,000 to 4,500 feet. Slopes are 0 to 4 percent. The native vegetation was mainly western wheatgrass, bluegrasses, rough fescue, sedges, bromegrass, and deciduous and evergreen trees. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 43 to 47 degrees F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark grayish brown clay loam 5 inches thick. The underlying material is 4 inches of grayish brown clay loam over brown and light brownish gray clay that extends to a depth of 60 inches or more.

Permeability is moderately slow. The available water capacity is moderate or high. Reaction is neutral to a depth of 20 inches and moderately alkaline below that depth.

Lohler soils are used mainly for irrigated crops and pasture. Some areas are used for dryfarming and for range.

Representative profile of Lohler clay loam, 0 to 2 percent slopes, 100 feet east and 200 feet south of the northwest corner of the NE1/4 of section 7, T. 3 S., R. 20 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and pores; neutral; clear wavy boundary.

C1—5 to 9 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse granular structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and pores; neutral; abrupt wavy boundary.

C2—9 to 20 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; massive; hard, firm, very sticky and plastic; few fine and very fine roots and pores; neutral; clear wavy boundary.

C3—20 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few very fine roots and pores; few fine distinct lime seams and threads; strongly effervescent; moderately alkaline.

The A horizon, where cultivated, is 2 to 6 inches thick. The A and C horizons are neutral to mildly alkaline to a depth of 20 inches. Some profiles have thin lenses of silt loam and loam.

**35—Lohler clay loam, 0 to 2 percent slopes.** This nearly level soil occupies terraces and alluvial fans. It has the profile described as typical of the series.

Included in mapping are a few small areas where the surface layer is silty clay loam. Also included are small areas of deep loam soils and some soils, mostly adjacent to the rivers, that have sand and gravel at a depth of 20 to 40 inches.

Surface runoff is slow, and the hazard of wind and water erosion is slight.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is also suited to wheat, barley, oats, and hay. It is well suited to range. Capability units IIs-1 (irrigated) and IIIs-2 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**36—Lohler clay loam, 2 to 4 percent slopes.** This is a gently sloping soil on terraces and alluvial fans.

Included in mapping are a few small areas where the surface layer is a silty clay loam, small areas of Work soil, small areas of a deep loam soil, and small areas where sand and gravel are at a depth of about 2 feet. These latter areas are mostly adjacent to rivers and drainageways.

Surface runoff is medium, and the hazard of water and wind erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is also suited to hay, wheat, barley, and oats. It is well suited to pasture and range. Capability units IIe-3 (irrigated) and IIIe-3 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Lolo series

The Lolo series consists of deep, well drained soils on alluvial terraces and fans at elevations of 3,500 to 5,000 feet. Slopes are 0 to 4 percent. The native vegetation was mainly bluegrass, basin wildrye, sedges, rough fescue, forbs, and deciduous and evergreen trees. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 42 to 47 degrees F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark grayish brown very gravelly loam 13 inches thick. The subsoil is dark brown very gravelly loam 11 inches thick. The substratum is light brownish gray very gravelly fine sandy loam to a depth of 60 inches or more.

Permeability is moderately rapid. The available water capacity is very low. Reaction is neutral to a depth of 13 inches and mildly alkaline below that depth.

These soils are used mainly for irrigated native grass pasture.

Representative profile of Lolo very gravelly loam in an area of Lolo complex, 0 to 4 percent slopes, 1,900 feet east and 140 feet south of the northwest corner of section 35, T. 5 S., R. 18 E.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; many fine pores; 45 percent pebbles and 5 percent cobbles; neutral; clear wavy boundary.

A12—3 to 13 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure that separates to weak medium and fine blocky; slightly hard, friable, slightly sticky and nonplastic; many fine and very fine roots and pores; 60 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

B2—13 to 24 inches; dark brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure that separates to weak medium and fine blocky; slightly hard, friable, sticky and nonplastic; 50 percent gravel and 10 percent cobbles; slightly effervescent; mildly alkaline; gradual wavy boundary.

C—24 to 60 inches; light brownish gray (10YR 6/2) very gravelly fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; very few fine roots; common clean fine sand grains; 50 percent pebbles; slightly effervescent; mildly alkaline.

The soil is 45 to 75 percent coarse fragments throughout. The coarse fragments are mainly gravel, but some profiles contain 25 to 35 percent cobbles. The B horizon is neutral or mildly alkaline.

**37—Lolo complex, 0 to 4 percent slopes.** This complex consists of nearly level to gently sloping soils on stream terraces and alluvial fans. Lolo very gravelly loam makes up about 35 percent of this complex and Lolo cobbly loam makes up 30 percent. The rest consists of soils that have a stony surface layer and subsoil, soils that have loose gravel and sand at a depth of 20 to 40 inches, and soils that do not contain so much gravel as is typical for the series. Also included are small areas of Work and Lohler soils.

In some places, the water table is at a depth of less than 30 inches during the irrigation season. Lolo very

gravelly loam has the profile described as typical for the series. Lolo cobbly loam is similar, but it has a cobbly loam surface layer and subsoil.

Surface runoff is slow. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

These soils are suited to hay production and range. Capability units IVe-1 (irrigated) and VIs-1 (dryland); Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

38—**Lolo and Nesda soils, flooded.** This undifferentiated unit consists of nearly level soils that are subject to flooding. The soils are on low stream terraces and flood plains along the rivers and large streams in the county. Lolo very gravelly loam makes up about 35 percent of this unit. It has a profile similar to that described as typical of the series; this soil, however, is subject to flooding. Nesda gravelly loam makes up about 30 percent of this unit. It has the profile described as typical of the Nesda series.

Included in mapping, and making up about 35 percent of the acreage, are small areas of soils that have loose very gravelly sand at a depth of 20 to 40 inches, soils that have cobbles and stones on the surface and throughout the profile, and small areas of Lohler soils. In places, the water table is at a depth of 10 to 30 inches during the irrigation season or when the streams are near flood stage. In areas of these soils near the Beartooth Mountains, the growing season is shorter than is typical for these soils.

Surface runoff is slow, and the hazard of wind and water erosion is slight. These soils are subject to channel and surface erosion when the streams are at flood stage.

These soils are suited to limited hay production, woodland, and range.

The Nesda and Lolo soils are mainly in plains cottonwood trees. In some areas, the Lolo soils are in ponderosa pine.

Plains cottonwoods can be expected to be 70 to 80 feet tall in 30 years (site index 70 to 80). Ponderosa pine on Lolo soils are expected to be 80 to 90 feet tall in 100 years. Expected volume at 70 years for fully stocked stands of cottonwood is 18,000 to 27,000 board feet, or 3,500 to 5,200 cubic feet, per acre.

When harvesting plains cottonwoods on these soils, clear cutting in small patches favors the regeneration of the plants, which cannot tolerate root and shade competition. Plains cottonwoods grow much faster than associated species on these soils.

Woodland management considerations are the moderate erosion hazard, equipment limitations, plant competition, slight windthrow hazard, and seedling mortality. The erosion hazard and equipment limitations are moderate because of flooding. Plant competition is moderate because the soils support dense stands of understory vegetation and cottonwood seedlings withstand competition poorly. Reducing plant competition may be necessary for good seedling survival.

These soils must be managed to promote revegetation of desirable trees and thereby maintain their value for wildlife habitat, rangeland, esthetics, and timber production. Capability unit VIw-1 (irrigated); Subirrigated range site; windbreak suitability group 4.

## Lonna series

The Lonna series consists of deep, well drained soils that formed in alluvium derived from siltstone and shale. Lonna soils are on alluvial fans and foot slopes at an elevation of 3,500 to 4,500 feet. Slopes are 2 to 15 percent. The native vegetation was mainly needleandthread, green needlegrass, western wheatgrass, threadleaf sedge, prairie junegrass, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 43 to 47 degrees F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish brown silt loam 2 inches thick. The subsoil is grayish brown silt loam 9 inches thick. The substratum is light brownish gray silt loam that has lenses of very fine sandy loam in the lower part and extends to a depth of 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Reaction is neutral to a depth of 11 inches and moderately alkaline below that depth.

Lonna soils are used mainly for dryland small grain crops, pasture, and range.

Representative profile of Lonna silt loam, 2 to 8 percent slopes, 1,800 feet south and 100 feet west of the northeast corner of section 6, T. 3 N., R. 20 E.

A1—0 to 2 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear smooth boundary.

B2—2 to 11 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; strong medium angular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and very fine roots and pores; neutral; clear smooth boundary.

C1ca—11 to 28 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many fine pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2cs—28 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; thin lenses of very fine sandy loam; few very fine roots; common threads and nodules of gypsum; strongly effervescent; moderately alkaline.

Reaction ranges from neutral to mildly alkaline to a depth of about 11 inches.

The B2 horizon has moderate or strong medium prismatic structure or strong medium or fine blocky structure. The B horizon is brown or grayish brown. The C horizon has few to many nodules and threads of gypsum.

39—**Lonna silt loam, 2 to 8 percent slopes.** This gently sloping and moderately sloping soil is on alluvial fans and foot slopes. It has the profile described as typical of the series.

Included in mapping are a few small areas of soils that have a fine sandy loam surface layer and a few areas of

soils that are strongly saline or very strongly saline. Small areas of Yamac and Wayden soils also are included.

Surface runoff is slow or medium. The hazard of water erosion is slight or moderate, and the hazard of wind erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is also suited to range. Capability unit IIIe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**40—Lonna silt loam, 8 to 15 percent slopes.** This strongly sloping soil is on alluvial fans and foot slopes.

Included in mapping are a few small areas of soils that have a very fine sandy loam surface layer and soils that are less sloping. Small areas of Yamac and Wayden soils are also included. In some places strongly alkaline or very strongly alkaline soils are included.

Surface runoff is medium and the hazard of water and wind erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is also well suited to pasture and range. Capability unit IVe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## McKenzie series

The McKenzie series consists of deep, poorly drained soils that formed in clay sediments weathered from shale. They occupy stream terraces and closed basins at elevations of 3,500 to 4,000 feet. Slopes are 0 to 5 percent. Native vegetation was mainly western wheatgrass, inland saltgrass, bluegrass, prairie junegrass, saltbush, greasewood, annual forbs, and other woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 43 to 47 degrees F. The frost-free season is 110 to 120 days.

In a representative profile the surface layer is light olive gray clay 4 inches thick. The subsoil is olive gray and light olive gray clay 13 inches thick. The substratum is light olive gray mottled clay to a depth of 60 inches or more.

Permeability is very slow. The available water capacity is high. Reaction is moderately alkaline to a depth of 13 inches and strongly alkaline below that depth.

These soils are used mainly for range.

Representative profile of McKenzie clay, saline, in native grass, 400 feet east and 800 feet south of the northwest corner of section 20, T. 2 N., R. 21 E.

A1—0 to 4 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; strong fine granular structure; hard, firm, sticky and plastic; many fine and very fine roots and pores; slightly effervescent; moderately alkaline; clear smooth boundary.

B21—4 to 13 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak medium prismatic structure that separates to moderate medium and fine subangular blocky; hard, firm, very sticky and very plastic; many fine and very fine roots and pores; strongly effervescent; moderately alkaline; clear smooth boundary.

B22—13 to 17 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; moderate medium and fine subangular blocky structure; hard, firm, very sticky and very plastic; common fine and very fine roots and pores; violently effervescent; strongly alkaline; clear smooth boundary.

C1—17 to 24 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine and very fine roots and tubular pores; fine irregular lime nodules and soft masses; violently effervescent; strongly alkaline; gradual smooth boundary.

C2cs—24 to 40 inches; light olive gray (5Y 6/2) clay; olive gray (5Y 4/2) with common medium distinct pale yellow (2.5Y 8/3) mottles, moist; massive; hard, firm, sticky and plastic; white (2.5Y 8/2) seams and pockets of lime and gypsum; strongly effervescent; strongly alkaline; gradual wavy boundary.

C3cs—40 to 60 inches; light brownish gray (2.5Y 6/2) clay, light yellowish brown (2.5Y 6/4) with common medium distinct pale yellow (2.5Y 8/3) mottles, moist; massive; hard, firm, sticky and plastic; large irregular pockets of gypsum crystals; slightly effervescent; strongly alkaline.

Some profiles have common pockets of salt crystals, and some have a vesicular surface crust.

**41—McKenzie clay, saline.** This nearly level soil occupies closed basins and stream terraces. Included in mapping are small areas where salt and alkali are at the surface. Some areas are ponded. Small areas of Lardell and Absher soils are also included.

Surface runoff is very slow. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

This soil is suited to range. Capability unit VIIw-1 (dryland); Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Nesda series

The Nesda series consists of deep, well drained soils that formed on alluvial fans and stream terraces or flood plains at elevations of 3,500 to 5,000 feet. The soils are underlain by sand, gravel, and cobbles at a depth of 14 to 20 inches. Slopes are 0 to 4 percent. The native vegetation was mainly bluegrass, cordgrass, willows, and deciduous and evergreen trees. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 42 to 47 degrees F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark grayish brown, dark brown, and brown gravelly loam 16 inches thick. The underlying material is pale brown very cobbly sand to a depth of 60 inches or more.

Permeability is moderately rapid in the upper 16 inches and rapid below that depth. The available water capacity is very low. Reaction is neutral to a depth of 16 inches and moderately alkaline in the underlying material.

Nesda soils are mainly used for irrigated native pasture.

Representative profile of Nesda gravelly loam in an area of Lolo and Nesda soils, flooded, 2,200 feet west and 100 feet south of the northeast corner of section 2, T. 5 S., R. 18 E.

A11—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; 20 percent pebbles and a few cobbles; many fine and very fine roots; neutral; clear wavy boundary.

A12—4 to 9 inches; dark brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 30 percent pebbles and 15 percent cobbles; neutral; gradual wavy boundary.

A13—9 to 16 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; 35 percent pebbles and 10 percent cobbles; neutral; gradual wavy boundary.

IIC—16 to 60 inches; pale brown (10YR 6/3) very cobbly sand, dark grayish brown (10YR 4/2) moist; single grained; loose; 50 percent cobbles and 15 percent pebbles; few lime coatings on undersides of coarse fragments at a depth of more than 30 inches; strongly effervescent; moderately alkaline.

The dark-colored surface layer ranges from 10 to 15 inches thick. Depth to loose very cobbly sand or stratified sand and gravel is 10 to 20 inches. Coarse fragments in the AB and IIC horizons range from 40 to 80 percent, and they range from mainly gravel to 60 percent cobbles.

Nesda soils are mapped only as an undifferentiated unit with Lolo soils.

## Rentsac series

The Rentsac series consists of shallow, well drained soils that formed in material weathered from sandstone. The soils are on uplands, at an elevation of 4,500 to 5,000 feet, and are underlain by bedrock at a depth of 10 to 20 inches. Slopes are 4 to 60 percent. The native vegetation was bluebunch wheatgrass, western wheatgrass, prairie junegrass, blue grama, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 42 to 47 degrees F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish brown loam about 8 inches thick. The underlying material is light brownish gray and light gray very channery loam 10 inches thick. It is underlain by hard sandstone.

Permeability is moderately rapid, and the available water capacity is very low. Reaction is mildly alkaline to a depth of about 8 inches and moderately alkaline below that depth.

These soils are used mainly for range. Some small areas are used for wheat and barley production.

Representative profile of Rentsac loam in an area of Tanna-Rentsac complex, 4 to 15 percent slopes, 100 feet south and 500 feet east of the northwest corner of section 18, T. 2 S., R. 20 E.

Ap—0 to 8 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; 15 percent thin sandstone channers; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C1—8 to 12 inches; light brownish gray (2.5Y 6/2) very channery loam, light olive brown (2.5Y 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots matted between sandstone channers; 55 percent sandstone channers; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—12 to 18 inches; light gray (2.5Y 7/2) very channery loam, light olive brown (2.5Y 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; 55 percent sandstone channers; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIR—18 to 24 inches; hard sandstone with lime crusts on bottoms of strata.

The depth to hard sandstone is 10 to 20 inches. Reaction is mildly alkaline or moderately alkaline to a depth of 8 inches and moderately alkaline below that depth; lime casts are on the undersides of the fractured sandstone. Coarse fragments range from 5 to 15 percent in the surface layer and from 35 to 70 percent in the C horizon.

**42—Rentsac loam, 15 to 30 percent slopes.** This is a moderately steep and steep soil on uplands. Included in mapping are small areas of Rock outcrop and of Tanna and Wayden soils. Also included are small areas of deep soils and soils that have a channery loam surface layer.

Surface runoff is rapid. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

This soil is suited to range. Capability unit VIe-1 (dryland); Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Rock outcrop

Outcrops of bedrock are common in some mapped areas. These areas range from steep to very steep and are used mainly for range and wildlife habitat.

**43—Rock outcrop-Castner association, steep.** This soil association consists of steep soils and Rock outcrop on foot slopes and mountainsides. The slopes are 25 to 55 percent. Rock outcrop makes up 50 percent of the unit and occurs throughout the areas. Castner loam makes up 35 percent of the unit and is mainly on the foot slopes and mountainsides. Included in mapping, and making up about 15 percent of the acreage, are Cheadle and Sebud soils and some small areas of stony and cobbly loam soils.

Surface runoff is rapid. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

This map unit is suited to range and to wildlife. Rock outcrop in capability class VIII, not assigned to a range site or windbreak group; Castner soil in capability unit VIIe-1 (dryland), Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**44—Rock outcrop-Garlet association, very steep.** This association consists of very steep soils and areas of Rock outcrop on foot slopes and mountainsides adjacent to and in the Beartooth Mountains. Rock outcrop makes up about 50 percent of the association and occurs in all areas of the association. Garlet cobbly loam makes up about 35 percent; it is on the foot slopes and in concave areas on the mountainsides. Slopes range from 45 to 75 percent. Rock outcrop is in the steeper areas.

About 15 percent of the association is made up of small areas of stony and very stony soils and areas of Cheadle and Sebud soils.

Surface runoff is rapid. The hazard of water erosion is severe, and that of wind erosion is slight.

The abundance of rock outcrop and the very steep slopes make this unit unsuitable for timber production. It is suited to watershed, recreation, and wildlife. Rock outcrop in capability class VIII; Garlet soils in capability unit VIIe-1.

**45—Rock outcrop-Yawdim association, steep.** This map unit consists of Rock outcrop and steep soils on hill-

sides and ridges. Outcrops of barren shale and rock make up about 65 percent of the unit; they are in the steeper areas. Yawdim clay loam makes up about 30 percent of the unit and occupies the lower slopes and concave areas. The slopes are 25 to 55 percent.

Included in mapping, and making up about 5 percent of the acreage, are small areas of Tanna and Yamac soils.

Surface runoff is rapid. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

This unit is suited to range and wildlife. Rock outcrop in capability class VIII, not assigned to a range site or windbreak group; Yawdim soil in capability unit VIIe-1 (dryland), Shallow Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Sebud series

The Sebud series consists of deep, well drained soils that formed in glacial till, alluvium, or colluvium derived from glacial till. These soils occupy uplands, foot slopes, and terraces at elevations of 4,500 to 6,000 feet. Slopes are 4 to 60 percent. The native vegetation was mainly bluegrass, western wheatgrass, rough fescue, bluebunch wheatgrass, green needlegrass, Idaho fescue, annual forbs, and woody plants. The mean annual precipitation is 19 to 24 inches. The mean annual soil temperature is 38 to 42 degrees F, and the frost-free season is 60 to 90 days.

In a representative profile the surface layer is very dark grayish brown and dark grayish brown stony loam 10 inches thick. The subsoil is yellowish brown extremely stony clay loam 14 inches thick. The substratum is very pale brown extremely stony sandy clay loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is low. Reaction is neutral.

These soils are used mainly for range and wildlife.

Representative profile of Sebud stony loam, 25 to 50 percent slopes, 400 feet north and 300 feet west of the southeast corner of section 21, T. 6 S., R. 17 E.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) stony loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; 20 percent pebbles, 10 percent stones and a few boulders; neutral; clear wavy boundary.

A12—4 to 10 inches; dark grayish brown (10YR 4/2) very stony loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots and a few fine pores; 10 percent pebbles and 40 percent stones; neutral; clear wavy boundary.

B2—10 to 24 inches; yellowish brown (10YR 5/4) very stony clay loam, dark yellowish brown (10YR 3/4) moist; weak medium and fine angular blocky structure; hard, firm, sticky and plastic; few coarse and very fine roots and pores; 10 percent pebbles and 40 percent stones and cobbles; neutral; gradual wavy boundary.

C—24 to 60 inches; very pale brown (10YR 7/4) very stony sandy clay loam; yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; many clear quartz sand grains; 5 percent weathered granitic rocks; 40 percent hard stones and cobbles; neutral.

The content of coarse fragments ranges from 15 to 30 percent in the A11 horizon and from 35 to 60 percent in the B and C horizons.

**46—Sebud stony loam, 4 to 25 percent slopes.** This moderately sloping to moderately steep soil is on foot slopes and hills. It formed in glacial deposits in valleys.

Included in mapping are a few small areas of a soil that has a clay loam surface layer. Small areas of Winkler and Hilger soils are also included. In some places, boulders are on the surface and in the soil.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to range. In areas where stones have been removed, the soil is suited to hay production. Capability unit VIe-1 (dryland); Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**47—Sebud stony loam, 25 to 50 percent slopes.** This steep soil is on mountainsides and foot slopes. It has the profile described as typical of the series.

Included in mapping are a few small areas of Winkler soils on the foot slopes and Garlet soils on the mountainsides. In some places there are boulders on the surface and in the soil. Also included are a few areas that have a clay loam surface layer.

Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

This soil is suited to range and wildlife. Capability unit VIIe-1 (dryland); Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**48—Sebud-Cheadle association, very steep.** This association consists of hilly to very steep soils on foot slopes and alluvial fans. Sebud stony loam makes up about 50 percent of the unit and is in the glacial till areas where slopes are 15 to 60 percent. Cheadle channery loam makes up about 30 percent of the unit and is in the steeper areas where slopes are 25 to 70 percent. The Cheadle soils have the profile described as typical of the Cheadle series.

Included in mapping, and making up about 20 percent of the acreage, are mainly Hilger and Winkler soils. Also included are small areas of Rock outcrop and areas that have rocks and boulders on the surface and in the soil.

Surface runoff is rapid. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

This soil is suited to range and wildlife. Capability unit VIIe-1 (dryland); windbreak suitability group 4; Sebud soil in Silty range site, 15- to 19-inch precipitation zone, and Cheadle soil in Shallow range site, 15- to 19-inch precipitation zone.

## Shane series

The Shane series consists of moderately deep, well drained soils that formed in clayey alluvium on uplands at elevations of 4,500 to 5,300 feet. Soft shale occurs at a depth of 20 to 40 inches. The slopes are 4 to 15 percent. The native vegetation was western wheatgrass, Idaho fescue, rough fescue, bluebunch wheatgrass, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 42 to 45 degrees F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark grayish brown and grayish brown clay loam 5 inches thick. The subsoil is dark grayish brown and brown clay 15 inches thick. The substratum is 10 inches of light olive gray clay overlying shale.

Permeability is very slow, and the available water capacity is low. Reaction is neutral to a depth of 20 inches and moderately alkaline below that depth.

These soils are used mainly for dryland crops, hay, pasture, and range.

Representative profile of Shane clay loam, 4 to 8 percent slopes, 1,300 feet north and 2,600 feet east of the southwest corner of section 9, T. 4 S., R. 20 E.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable, nonsticky and nonplastic; many fine and very fine roots and pores; neutral; abrupt wavy boundary.

A12—3 to 5 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong very thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and pores; neutral; abrupt smooth boundary.

B21t—5 to 14 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure that separates to strong medium and fine blocky; hard, firm, sticky and plastic; many fine and very fine roots and pores; common distinct clay films on peds; neutral; clear wavy boundary.

B22t—14 to 20 inches; brown (10YR 4/3) clay, dark grayish brown (10YR 4/2) moist; strong coarse angular blocky structure; extremely hard, very firm, sticky and plastic; many very fine roots and pores; common distinct clay films on peds; neutral; clear wavy boundary.

C1ca—20 to 30 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; weak coarse angular blocky structure; extremely hard, firm, sticky and plastic; few very fine roots; many nodules, seams and threads of segregated lime; few small shale chips and sandstone fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

C2r—30 to 60 inches; olive (5Y 5/4) shale with pockets of gypsum crystals between shale layers; strongly effervescent; moderately alkaline.

Depth to bedrock is 20 to 40 inches. Cultivated soils have a dark grayish brown Ap horizon 3 to 7 inches thick. The B2t horizon is clay or silty clay.

**49—Shane clay loam, 4 to 8 percent slopes.** This moderately sloping soil is on foot slopes and stream terraces. It has the profile described as typical of the series. Included in mapping are a few small areas that have a silty clay loam surface layer. Small areas of Absarokee and Hilger soils are also included.

Surface runoff is medium. The hazard of wind erosion is slight and the hazard of water erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is suited to range. Capability unit IIIe-1 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**50—Shane clay loam, 8 to 15 percent slopes.** This strongly sloping soil occupies foot slopes and stream terraces. Included in mapping are a few small areas where the surface layer is silty clay loam. Small areas of Absarokee and Hilger soils are also included.

Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is suited to range. Capability unit IVe-1 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**51—Shane-Cabba clay loams, 4 to 10 percent slopes.** This complex consists of moderately sloping to strongly sloping soils on foot slopes. About 50 percent of this unit is Shane clay loam and about 30 percent is Cabba clay loam. The Shane soil occupies the broad, smooth slopes and swales, and the Cabba soil occupies the convex areas and narrow ridges. The Cabba soil has the profile described as typical of the Cabba series. Small areas of Absarokee and Hilger soils are included in mapping and make up about 20 percent of the acreage.

Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Soils in this complex are suited to wheat, barley, oats, and hay production under dryfarm management. They are suited to range. Capability unit IIIe-1 (dryland); Shane soil in Clayey range site, 15- to 19-inch precipitation zone, and windbreak suitability group 3M; Cabba soil in Shallow range site, 15- to 19-inch precipitation zone, windbreak suitability group 4.

## Shawa series

The Shawa series consists of deep, well drained soils on stream terraces and alluvial fans at an elevation of 4,000 to 5,000 feet. Slopes are 0 to 8 percent. The native vegetation was mainly rough fescue, Idaho fescue, Columbia needlegrass, bluegrass, lupine, shrubby cinquefoil, annuals, other forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 40 to 45 degrees F. The frost-free season is 90 to 110 days.

In a representative profile the surface layer is very dark gray and dark gray silty clay loam and clay loam 26 inches thick. The underlying material is grayish brown clay loam that extends to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is high. Reaction is neutral.

These soils are used mainly for irrigated and dryland small grains, for hay and pasture, and for range.

Representative profile of Shawa silty clay loam, 0 to 8 percent slopes, in native grass, 1,320 feet west and 300 feet south of the northeast corner of section 25, T. 4 S., R. 18 E.

A11—0 to 5 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear smooth boundary.

A12—5 to 18 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate medium and fine blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots; neutral; clear smooth boundary.

A13—18 to 26 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots; common fine sand grains; 5 percent pebbles and cobbles; neutral; clear smooth boundary.

C—26 to 40 inches; grayish brown (10YR 5/2) clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, firm, sticky and plastic; few fine roots; neutral.

The surface layer ranges in thickness from 20 to 26 inches and is silty clay loam or clay loam. Pebbles and rock fragments occur throughout the soil. Sandstone, quartzite, or shale is at a depth of more than 40 inches in some profiles. Some profiles have an accumulation of lime in the C horizon.

**52—Shawa silty clay loam, 0 to 8 percent slopes.** This nearly level to moderately sloping soil occupies stream terraces and alluvial fans.

Included in mapping are a few small areas that have a clay loam surface layer and subsoil. Some small areas have many cobbles and stones on the surface and throughout the soil. Small areas of Work and Turner soils are also included. Some small areas adjacent to streams are subject to flooding. Areas of this Shawa soil near the Beartooth Mountains are colder than is typical for the series.

Surface runoff is slow or medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is suited to wheat, barley, oats, and hay. It is also suited to range and, to less extent, to timber production.

This Shawa soil is used to grow mainly quaking aspen. Quaking aspen on this soil is expected to be 49 to 55 feet tall at 80 years of age (site index 49 to 55). At 70 years, it is expected to yield 2,000 to 2,400 cubic feet of board per acre (whole tree).

Trees should be harvested by clearcutting, which favors plant regeneration. Quaking aspen does not tolerate much plant competition but sprouts readily from its roots when harvested.

Woodland management considerations are slight hazards of erosion, windthrow, and seedling mortality, moderate equipment limitations, and moderate plant competition.

Equipment limitations are rated as moderate because the soil has poor trafficability and is susceptible to compaction when wet. Plant competition is rated as moderate because the soil supports dense stands of understory vegetation.

Careful management is needed to provide for good regeneration when the timber is harvested. Capability units IIIe-2 (irrigated), and IIIe-2 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Sinnigam series

The Sinnigam series consists of shallow, well drained soils that formed in material weathered from hard sandstone. These soils occupy uplands at elevations of 4,500 to 5,000 feet. They are underlain by bedrock at a depth of 10 to 20 inches. Slopes are 2 to 30 percent. Native vegetation was mainly bluebunch wheatgrass, Idaho fescue, rough fescue, bluegrass, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 42 to 47 degrees F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark grayish brown clay loam and channery clay loam 5 inches thick. The subsoil is grayish brown very channery silty clay 13 inches thick. The substratum is light olive brown weathered shale and interbedded hard sandstone.

Permeability is moderately slow, and the available water capacity is very low. Reaction is neutral.

These soils are used mainly for dryland crops, pasture, and range.

Representative profile of Sinnigam clay loam in an area of Absarokee-Sinnigam clay loams, 2 to 8 percent slopes, 2,800 feet north and 100 feet east of the southwest corner of section 5, T. 4 S., R. 20 E.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; neutral; clear wavy boundary.

A12—2 to 5 inches; dark grayish brown (10YR 4/2) channery clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium platy structure that separates to weak fine granular; slightly hard, friable, sticky and plastic; many fine and very fine roots; 40 percent channers; neutral; clear smooth boundary.

B2t—5 to 18 inches; grayish brown (10YR 5/2) very channery clay, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure that separates to moderate medium and fine blocky; hard, firm, sticky and plastic; distinct clay films on peds; many very fine matted roots; 50 percent channers; neutral; clear wavy boundary.

IIR—18 inches; light olive brown (2.5Y 5/6) weathered clay shale and interbedded hard sandstone; clay coats the sandstone fragments in the upper part.

The A horizon is 4 to 6 inches thick. Depth to sandstone ranges from 10 to 20 inches. The content of coarse fragments ranges from 30 to 50 percent in the A horizon and from 45 to 70 percent in the B2t horizon.

Sinnigam soils are mapped only with Absarokee soils.

## Tanna series

The Tanna series consists of moderately deep, well drained soils that formed in material weathered from sandstone and shale. These soils occupy uplands at an elevation of 4,500 to 5,500 feet and are underlain at a depth of 20 to 40 inches by soft shale. Slopes are 2 to 15 percent. Native vegetation was mainly western wheatgrass, green needlegrass, prairie junegrass, needleandthread, threadleaf sedge, annual forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 43 to 47 degrees F. The frost-free season is 105 to 120 days.

In a representative profile the surface layer is grayish brown clay loam 7 inches thick. The subsoil is light olive brown and light yellowish brown silty clay 13 inches thick. The substratum is 14 inches of light olive gray clay loam overlying light olive gray shale at a depth of 34 inches.

Permeability is slow, and the available water capacity is low. Reaction is mildly alkaline to a depth of 13 inches and moderately alkaline below that depth.

These soils are used mainly for dryland crops, pasture, and range.

Representative profile of Tanna clay loam, in an area of Tanna-Rentsac complex, 4 to 15 percent slopes, 1,980 feet west and 1,800 feet north of the southeast corner of section 32, T. 2 N., R. 20 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable, sticky and plastic; few very fine roots and pores; mildly alkaline; clear wavy boundary.

B21t—7 to 13 inches; light olive brown (2.5Y 5/3) silty clay, olive brown (2.5Y 4/3) moist; strong medium prismatic structure that separates to moderate fine and very fine blocky; extremely hard, firm, sticky and plastic; common distinct clay films on peds; few very fine roots and pores; mildly alkaline; clear smooth boundary.

B22t—13 to 17 inches; light yellowish brown (2.5Y 6/3) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure that separates to strong medium and fine blocky; very hard, firm, sticky and plastic; few distinct clay films on peds; few very fine roots and pores; slightly effervescent; moderately alkaline; clear smooth boundary.

B3tca—17 to 20 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; strong medium prismatic structure that separates to moderate medium and fine blocky; very hard, firm, sticky and plastic; few discontinuous clay films on peds; few very fine roots and pores; few lime nodules and seams; strongly effervescent; strongly alkaline; gradual wavy boundary.

C1ca—20 to 34 inches; light olive gray (5Y 6/2) clay loam, olive (5Y 5/3) moist; weak coarse prismatic structure that separates to moderate fine blocky; hard, firm, sticky and plastic; a few shale chips; strongly effervescent; moderately alkaline; clear wavy boundary.

IIC2r—34 inches; light olive gray (5Y 6/2) shale.

The A horizon, if cultivated, is 6 to 8 inches thick. Depth to shale ranges from 20 to 40 inches. The B2t horizon is clay or silty clay.

**53—Tanna clay loam, 2 to 8 percent slopes.** This gently sloping and moderately sloping soil is on uplands.

Included in mapping are a few small areas that are less sloping or are steeper. Also included are a few small areas that have a loam surface layer. Small areas of Beenom and Rentsac soils are also included.

Surface runoff is medium and the hazard of wind and water erosion is moderate.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. It is also suited to range. Capability unit IIIe-1 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**54—Tanna clay loam, 8 to 15 percent slopes.** This strongly sloping soil is on uplands. Included in mapping are a few small areas of soils that have slopes steeper than 15 percent or that have a clay surface layer. Small areas of Beenom and Rentsac soils are also included.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to wheat, barley, oats, and hay production under dryfarm management. This soil is also suited to range. Capability unit IVe-1 (dryland); Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**55—Tanna-Beenom complex, 4 to 8 percent slopes.** This complex consists of moderately sloping soils on uplands. About 70 percent is Tanna clay loam and about 20 percent is Beenom loam. Tanna clay loam occupies the swales and the lower part of the slopes, and Beenom loam occupies the upper part of the slopes and the convex areas. Included in mapping, and making up about 10 percent of the acreage, are Cabba and Rentsac soils. The Beenom soil has the profile described as typical of the Beenom series.

Surface runoff is medium, and the hazard of water and wind erosion is moderate.

Soils in this complex are suited to wheat, barley, and hay production under dryfarm management. They are also suited to range. Capability unit IIIe-1 (dryland); Tanna soil in Clayey range site, 10- to 14-inch precipitation zone, and windbreak suitability group 3M; Beenom soil in Shallow range site, 10- to 14-inch precipitation zone, and windbreak suitability group 4.

**56—Tanna-Rentsac complex, 4 to 15 percent slopes.** This complex consists of moderately sloping and strongly sloping soils on uplands. About 55 percent is Tanna clay loam, 20 percent is Rentsac loam, and 15 percent is Rentsac channery loam. Tanna clay loam occupies the swales and the lower part of the slopes. Rentsac soils occupy the convex ridges and the upper part of the slopes. Included in mapping, and making up about 10 percent of the acreage, are Lambeth, Cabba, and Beenom soils and some small areas where the soil has a loam surface layer and is nearly level. The Tanna soil has the profile described as typical of the series. Rentsac loam has the profile described as typical of the Rentsac series.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Soils in the complex are suited to wheat, barley, oats, and hay under dryfarm management. This complex is also suited to range. Capability unit IIIe-1 (dryland); Tanna soil in Clayey range site, 10- to 14-inch precipitation zone, and windbreak suitability group 3M; Rentsac soil in Shallow range site, 10- to 14-inch precipitation zone, and windbreak suitability group 4.

## Torrifluvents-Camborthids

**57—Torrifluvents-Camborthids association, gently sloping.** This association consists of deep, well drained soils; it is 45 percent Torrifluvents and 35 percent Camborthids. The Torrifluvents are on the low stream terraces and flood plains adjacent to narrow streams and broad drainageways.

The Camborthids are on fans and terraces above the streams and drainageways. The slopes range from 0 to 2 percent for the Torrifluvents and from 2 to 4 percent for the Camborthids. The soils range from sandy loam to silty clay and are mostly more than 40 inches deep to sand and gravel. About 20 percent of this association consists of soils that have sand and gravel at a depth of 20 to 40 inches and small areas of wet and saline soils.

These soils mostly support grass vegetation. In most places a few trees grow along the drainageways and

streams. Stream channels and side drainageways dissect the areas and limit the possibility of cultivation. The tillable areas vary in size, but most are small and irregular. Some parts of this association are flooded as a result of snowmelt early in spring.

The hazard of water erosion is moderate or severe, and the hazard of wind erosion is slight.

These soils are best suited to range. Some areas are suited to hay production under dryfarm management. Capability unit IVe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Turner series

The Turner series consists of deep, well drained soils that formed in glacial outwash on terraces and alluvial fans at an elevation of 4,500 to 5,500 feet. The soils are underlain by sand and gravel at a depth of 20 to 40 inches. Slopes are 2 to 15 percent. Native vegetation is bluebunch wheatgrass, bluegrass, spike fescue, rough fescue, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 39 to 42 degrees F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is brown clay loam about 3 inches thick. The subsoil is dark yellowish brown clay loam 8 inches thick. The substratum is 11 inches of light brownish gray clay loam overlying very gravelly sand.

Permeability is moderate to a depth of 22 inches and is rapid below that depth. The available water capacity is low. Reaction is neutral to a depth of 11 inches and moderately alkaline below that depth.

These soils are used mainly for dryland pasture and range.

Representative profile of Turner clay loam, 2 to 4 percent slopes, 2,000 feet east and 100 feet south of the northwest corner of section 6, T. 4 S., R. 19 E.

A1—0 to 3 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; neutral; 10 percent cobbles; clear wavy boundary.

B2t—3 to 11 inches; dark yellowish brown (10YR 4/4) clay loam, dark brown (10YR 3/3) moist; weak medium and fine blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; common thin clay films on peds; 15 percent cobbles and pebbles; neutral; abrupt wavy boundary.

C1ca—11 to 22 inches; light brownish gray (10YR 6/2) clay loam, very pale brown (10YR 7/4) moist; massive; slightly hard, friable, sticky and plastic; few fine and very fine roots; common lime segregations; 15 percent cobbles and pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIC2—22 to 60 inches; very gravelly sand; single grained; loose; few cobbles; strongly effervescent; moderately alkaline.

The A horizon is clay loam or stony clay loam. Depth to sand and gravel ranges from 20 to 40 inches. Texture of the B2t and Cca horizons in places is cobbly clay loam or gravelly clay loam that is 10 to 35 percent coarse fragments.

**58—Turner clay loam, 2 to 4 percent slopes.** This gently sloping soil is on alluvial fans and terraces. It has the profile described as typical of the series. In some places the depth to sand and gravel is less than 20 inches or more than 40 inches.

Small areas of Work soils are included in mapping. Also included are small areas of loam and areas of a soil that has cobbles and stones throughout the profile. In some places where they are irrigated, these soils have a seasonal water table at a depth of about 20 inches. In the vicinity of Absarokee and south to the county line the growing season is somewhat shorter than is typical for the series.

Surface runoff is medium. The hazard of water erosion is slight or moderate, and the hazard of wind erosion is moderate.

This soil is suited to wheat, barley, oats, and hay under dryfarm management and under irrigation. It is also suited to range. Capability units IIe-1 (irrigated) and IIIs-1 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**59—Turner clay loam, 4 to 8 percent slopes.** This moderately sloping soil is on ridgetops and side slopes of terraces and alluvial fans. Included in mapping are small areas of less sloping and steeper soils. Some areas of soils that have loose sand and gravel at a depth of 20 to 40 inches or have cobbles and stones throughout the profile and small areas of Work soils are also included. In the vicinity of Absarokee and south to the county line the growing season is somewhat shorter than is typical for the series.

Surface runoff is medium, and the hazard of water and wind erosion is moderate.

This soil is suited to wheat, barley, oats, and hay under dryfarm management and under irrigation. It is also suited to range. Capability units IIIe-3 (irrigated) and IIIe-4 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**60—Turner stony clay loam, 4 to 15 percent slopes.** This moderately sloping and strongly sloping soil occupies outwash terraces, stream terraces, and alluvial fans. It has a profile similar to that described as typical for the series, except that there are more cobbles and stones throughout the profile.

Included in mapping are some areas of less sloping soils and small areas of Work soils. Near Absarokee and south to the county line the growing season is somewhat shorter than is typical for the series.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to range. Capability unit IVe-3 (dryland); Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

## Ustifluvents-Fluvaquents

**61—Ustifluvents-Fluvaquents association, flooded.** This association consists of deep, well drained and very poorly drained soils. Ustifluvents make up about 45 percent and Fluvaquents make up about 40 percent of the

association. The soils are on flood plains of the Yellowstone River and its larger tributaries. They are mostly more than 40 inches deep, but in some places, sand and gravel are at a depth of 20 to 40 inches or are at the surface. Included with these soils in mapping are gravel bars and sand deposits, which make up about 15 percent of the acreage.

Cottonwood trees, ponderosa pine, and brush are the dominant vegetation. There are some grassland areas and some small areas that can be cultivated if accessible.

The water table is at or near the surface in some areas. Stream dissecting occurs in most years, and the soils are flooded in the spring from snow melt or from ice jams that form late in winter.

The hazard of water erosion is high, and the hazard of wind erosion is slight. These soils are suited mainly to range and timber production.

Forested areas of moderately deep to deep Ustifluvents and Fluvaquents are mainly in plains cottonwood. Soils that are shallow or very shallow to gravel or have gravel exposed at the surface are mostly covered with narrowleaf cottonwood. Plains cottonwood is expected to be 70 to 80 feet tall in 30 years (site index 70 to 80) on the moderately deep and deep included soils in this unit. Narrowleaf cottonwoods growing on the included soils that are shallow or very shallow to gravel or on exposed gravel bars in this unit are expected to be 20 to 30 feet tall in 30 years. Fully stocked stands of plains cottonwood are expected to produce 18,000 to 27,000 board feet per acre. Narrowleaf cottonwoods on the soils that are shallow or very shallow to gravel are estimated to yield from 2,000 to 7,000 board feet, or 400 to 1,300 cubic feet of timber.

Plains cottonwood harvested on the deeper soils should be clearcut in small patches to favor plant regeneration. Plains cottonwood cannot tolerate root and shade competition, and it grows much faster than associated species on these soils. Trees on the soils that are shallow to gravel should be left uncut.

Woodland management considerations for the moderately deep and deep soils of this map unit are moderate erosion hazard, moderate equipment limitations, moderate plant competition, slight seedling mortality, and slight windthrow hazard. Management considerations for the soils that are shallow or very shallow to gravel are slight windthrow hazard, moderate erosion hazard, moderate equipment limitations, moderate plant competition, and severe seedling mortality.

The erosion hazard and equipment limitations on all the soils of this map unit are moderate because of flooding. Plant competition is moderate on the deep soils because they support dense stands of understory vegetation and cottonwood seedlings withstand competition poorly. Seedling mortality is rated severe and plant competition is rated moderate on the shallow or very shallow to gravel soils because of the very low available water capacity and occasional flooding.

Good management should assure good revegetation of harvested areas. Ustifluvents in capability unit VIw-1 (dryland), Silty range site, 10- to 14-inch precipitation zone, windbreak suitability group 1; Fluvaquents in capability unit VIw-1 (irrigated), Subirrigated range site, windbreak suitability group 4.

## Ustifluvents-Ustochrepts

**62—Ustifluvents-Ustochrepts association, gently sloping.** This association consists of deep, well drained soils. Ustifluvents make up about 45 percent of the association and occupy the low stream terraces adjacent to narrow streams and in broad drainageways. Ustochrepts make up about 40 percent of the association and are on alluvial fans and terraces above the streams in broad drainageways. The slopes mostly range from 0 to 2 percent for the Ustifluvents and 2 to 4 percent for the Ustochrepts. The soils range from sandy loam to silty clay and are mostly more than 40 inches deep to sand and gravel. About 15 percent of the association consists of soils 20 to 40 inches deep over sand and gravel, small areas of wet and saline soils, and areas where gravel or cobbles are on the surface.

These soils mostly support grass vegetation. In some places, trees grow along the drainageways and streams. Stream channels and side drainageways dissect the unit and limit the possibility for cultivation. The tillable areas vary in size, but most are small and irregular. Some parts of this association receive overflow from snowmelt early in spring. The hazard of water erosion is moderate or severe, and the hazard of wind erosion is slight.

These soils are mainly suited to range. Some areas are suited to hay production under dryfarm management. Capability unit IVe-2 (dryland); Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Wayden series

The Wayden series consists of shallow, well drained soils that formed in material weathered from shale. These soils occupy uplands at 4,000 to 5,000 feet elevation. They are underlain by bedrock at a depth of 10 to 20 inches. Slopes are 15 to 50 percent. Native vegetation was bluebunch wheatgrass, western wheatgrass, rough fescue, big bluegrass, Idaho fescue, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 45 to 47 degrees F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish brown clay loam 6 inches thick. The underlying material is 8 inches of light brownish gray heavy clay loam overlying weathered shale.

Permeability is slow, and the available water capacity is very low. Reaction is moderately alkaline.

These soils are used mainly for range.

Representative profile of Wayden clay loam in an area of Wayden-Castner association, steep, 2,400 feet west and

1,200 feet north of the southeast corner of section 17, T. 4 S., R. 19 E.

A1—0 to 6 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine granular structure; hard, firm, sticky and plastic; many fine and very fine roots and pores; slightly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—6 to 14 inches; light brownish gray (2.5Y 6/2) heavy clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; many fine and very fine roots; about 2 percent clayey and sandy soft shale fragments; common lime segregations; strongly effervescent; moderately alkaline; clear smooth boundary.

C2r—14 to 20 inches; weathered shale with pockets of gypsum crystals between shale layers; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C3r—20 to 60 inches; shale.

Depth to shale ranges from 10 to 20 inches. The texture of the upper part of the C horizon is clay loam, clay, or silty clay.

**63—Wayden-Castner association, steep.** This association consists of 50 percent Wayden clay loam and 30 percent Castner channery loam. Wayden soils occupy the lower part of the slopes. Castner soils occupy the upper part of the slopes and ridges. Slopes are 15 to 50 percent. Included in mapping and making up about 20 percent of the association are Cabba and Hilger soils and Rock outcrop.

Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

The soils in this association are used mainly for range. Capability unit VIIe-1 (dryland); windbreak suitability group 4; Wayden soil in Shallow Clay range site, 15- to 19-inch precipitation zone, Castner soil in Shallow range site, 15- to 19-inch precipitation zone.

## Winkler series

The Winkler series consists of deep, well drained soils that formed in colluvium and residuum of weathered sandstone, shale, and mixed igneous rock. Winkler soils are on mountainsides and foot slopes at an elevation of 4,000 to 6,000 feet. Slopes are 25 to 60 percent. Native vegetation was mainly ponderosa pine and Rocky Mountain juniper with an understory of bluebunch wheatgrass and skunkbush sumac. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 42 to 47 degrees F. The frost-free season is 90 to 120 days.

In a representative profile the surface layer is light brownish gray gravelly sandy loam 3 inches thick. The subsurface horizon is very pale brown gravelly sandy loam 12 inches thick. The subsoil is pale brown and brown gravelly sandy loam that extends to a depth of 60 inches or more.

Permeability is moderately rapid, and the available water capacity is low. The reaction is neutral throughout.

These soils are mainly used for timber production.

Representative profile of Winkler gravelly sandy loam in an area of Winkler-Hilger-Rock outcrop association, steep, 280 feet east and 800 feet north of the southwest corner of section 5, T. 4 S., R. 17 E.

O1—1 inch to 0; forest litter of ponderosa pine needles.

A1—0 to 3 inches; light brownish gray (10YR 6/2) gravelly sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many fine and medium pores; 25 percent pebbles; neutral; clear smooth boundary.

A2—3 to 15 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine and medium pores; 35 percent pebbles; neutral; clear smooth boundary.

A&B—15 to 37 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; intermixed with brown (10YR 5/3) and dark yellowish brown (10YR 4/4); moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium and coarse roots; common fine and medium pores; 40 percent pebbles; neutral; clear smooth boundary.

B2—37 to 60 inches; brown (10YR 5/3) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and plastic; common fine and medium roots; common fine and medium pores; thin sandy clay loam bands; 45 percent pebbles; neutral.

The A&B and B horizons are loam or sandy loam. They generally contain 35 to 70 percent pebbles, but some profiles contain cobbles and stones.

**64—Winkler-Hilger-Rock outcrop association, steep.** This association consists of about 45 percent Winkler gravelly sandy loam, 25 percent Hilger cobbly sandy loam, and 20 percent Rock outcrop. It is on mountainsides and foot slopes. Slopes are 25 to 60 percent.

Included in mapping are some soils that have a channery loam surface layer, some that have bedrock at a depth of 20 to 60 inches, and some small areas where bedrock is less than 20 inches deep. Also included are some timbered areas where the soil has more clay in the subsoil than is typical for the Winkler series and some grassland areas where the soil has less clay in the subsoil than is typical for the Hilger series.

Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

The Winkler soils are mainly used for timber production and for wildlife. The Hilger soils are mainly used for range, timber production, and for wildlife. Most of the forested areas are on the Winkler soils.

Winkler soils and Hilger soils are suited to production of ponderosa pine. Rocky Mountain juniper grows on these soils, but it is not considered a commercial species. Ponderosa pines are the best trees to plant. Stand regeneration is often very slow if stands are greatly opened with seed tree or clearcut systems.

These soils are capable of producing 3,900 to 5,100 cubic feet of wood per acre, or 12,000 to 16,000 board feet of merchantable timber from a fully stocked, even-aged stand of 100-year-old ponderosa pines. The tree height is expected to be 60 to 80 feet at 100 years (site index 60 to 80).

Woodland management considerations for the Winkler soils include moderate equipment limitations and moderate erosion hazard because of the steep slopes; severe seedling mortality and severe plant competition because of the low available water capacity and the warm south aspect of many sites; and slight windthrow hazard.

Management considerations for the Hilger soils include moderate equipment limitations and moderate erosion hazard because of the steep slopes; only moderate seedling mortality and moderate plant competition because they have a more favorable available water capacity than the Winkler soils; and slight windthrow hazard.

Rock outcrop occurs throughout the map unit and must be considered in harvesting timber. Use of machinery is hampered by the outcrops, and road construction can be costly in areas of rock outcrop.

The understory vegetation consists mainly of bluebunch wheatgrass, Idaho fescue, skunkbush sumac, and Rocky Mountain juniper on the warmer slopes and bluebunch wheatgrass, Idaho fescue, pinegrass, elk sedge, arrowleaf balsamroot, snowberry, ninebark, and kinnikinnick on the cooler slopes. Many of these plants have fair to good forage value for cattle, deer, and elk.

The estimated total average annual air-dry yields of understory plants is 1,250 pounds per acre where there is a 10 to 30 percent canopy cover and 470 pounds per acre where there is a 50 to 70 percent canopy cover. An estimated 80 percent of the above yields is potential feed for grazing animals.

Management should keep soil losses to a minimum, promote revegetation of desirable trees, and keep the plant understory in good condition to maintain the value of these soils for watershed, aesthetic uses, wildlife, rangeland, and timber production. Adequate provisions must be made to safeguard the trees from fire and harmful insects. Winkler and Hilger soils in capability unit VIIe-1, and Rock outcrop in capability class VIII.

## Work series

The Work series consists of deep, well drained soils that formed in alluvium derived from shale, sandstone, and till. These soils are on alluvial fans and foot slopes at elevations of 4,000 to 4,500 feet. Slopes are 4 to 15 percent. The native vegetation was mainly basin wildrye, western wheatgrass, Idaho fescue, rough fescue, annual forbs, and woody plants. The mean annual precipitation is 15 to 19 inches. The mean annual soil temperature is 45 to 47 degrees F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish brown loam 5 inches thick. The subsoil is dark grayish brown and brown clay loam 23 inches thick. The substratum is very pale brown gravelly loam to a depth of 60 inches or more.

Permeability is moderately slow, and the available water capacity is high. Reaction is neutral to a depth of 16 inches and is moderately alkaline below that depth.

These soils are used mainly for dryland and irrigated crops, pasture, and range. Some areas are used for irrigated crops.

Representative profile of Work loam, 4 to 8 percent slopes, 1,100 feet west and 800 feet south of the northeast corner of the NW1/4 of section 8, T. 4 S., R. 19 E.

A11—0 to 2 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak thin platy structure that separates to fine granular; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and pores; neutral; clear wavy boundary.

A12—2 to 5 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium platy structure that separates to weak very fine blocky; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; clear wavy boundary.

B2t—5 to 16 inches; dark grayish brown (2.5Y 4/2) heavy clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure that separates to moderate medium blocky; slightly hard, firm, sticky and plastic; many very fine roots and tubular pores; many small clear quartz grains coating peds; prominent clay films on peds; neutral; clear wavy boundary.

B3ca—16 to 28 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine blocky structure; slightly hard, firm, sticky and plastic; few fine and very fine roots; common seams, threads and pockets of segregated lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IICca—28 to 60 inches; very pale brown (10YR 7/3) gravelly loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and plastic; 30 percent lime-coated pebbles and cobbles; few fine lime segregations; strongly effervescent; moderately alkaline.

The A horizon, if cultivated, is 6 to 8 inches thick. The texture of the B2t horizon is clay loam or clay.

**65—Work loam, 4 to 8 percent slopes.** This gently sloping and moderately sloping soil occupies alluvial fans and foot slopes. It has the profile described as typical of the series. Included in mapping are a few small areas that have a cobbly loam surface layer and silty clay loam subsoil. Small areas of Absarokee, Amherst, and Lohler soils are also included. In some small areas, bedrock occurs at a depth of 10 to 40 inches.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to wheat, barley, and hay production under dryfarm management. Under irrigation, it is suited to oats and hay. It is also suited to range. Capability units IIIe-1 (irrigated), IIIe-3 (dryland); Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**66—Work loam, 8 to 15 percent slopes.** This is a strongly sloping soil on alluvial fans and foot slopes. Included in mapping are a few small areas where the slopes are steeper. Small areas of Absarokee and Amherst soils and of Rock outcrop are also included. In some small areas, bedrock is at a depth of 20 to 40 inches.

Surface runoff is rapid. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to wheat, barley, and hay production under dryfarm management. It is also suited to range. Capability unit IVe-2 (dryland); Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Yamac series

The Yamac series consists of deep, well drained soils that formed in alluvium derived from soft shale. Yamac soils are on alluvial fans and foot slopes at elevations of 3,000 to 4,000 feet. Slopes are 0 to 8 percent. The native vegetation was mainly western wheatgrass, blue grama,

little bluestem, needlandthread, forbs, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 49 degrees F. The frost-free season is 105 to 120 days.

In a representative profile the surface layer is grayish brown loam 8 inches thick. The subsoil is brown and light brownish gray loam 12 inches thick. The substratum is light brownish gray loam and clay loam that extends to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is high. Reaction is mildly alkaline to a depth of 15 inches and moderately alkaline below that depth.

These soils are used mainly for dryland and irrigated small grains, sugar beets, corn for silage, and hay. They are suited to pasture and range.

Representative profile of Yamac loam, 2 to 4 percent slopes, 2,100 feet east and 50 feet south of the northwest corner of section 3, T. 3 N., R. 20 E.

Ap—0 to 8 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium platy structure; slightly hard, friable, sticky and plastic; common coarse, medium, fine and very fine roots; slightly effervescent; mildly alkaline; clear wavy boundary.

B2—8 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium prismatic structure that separates to strong angular blocky; slightly hard, friable, sticky and plastic; common medium fine and very fine roots; common very fine pores; slightly effervescent; mildly alkaline; clear smooth boundary.

B3ca—15 to 20 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse angular blocky structure; soft, friable, slightly sticky and slightly plastic; common medium fine and very fine roots and pores; common distinct seams and threads of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C1ca—20 to 36 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots and pores; fine disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C2ca—36 to 48 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; few fine and very fine roots; fine segregated lime in soft masses; violently effervescent; moderately alkaline; gradual wavy boundary.

C3—48 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; few soft lime masses; violently effervescent; moderately alkaline.

The A horizon is 3 to 4 inches thick in areas that are not cultivated. Some profiles contain 5 to 10 percent pebbles.

**67—Yamac loam, 0 to 2 percent slopes.** This is a nearly level soil on stream terraces and alluvial fans. Included in mapping are a few small areas of soils that have a clay loam surface layer and clay loam subsoil, soils that have sand and gravel at a depth of 40 to 60 inches, and small areas of Lonna and Attewan soils.

Surface runoff is medium, and the hazard of wind and water erosion is slight.

Under irrigation, this soil is suited to wheat, barley, oats, hay, corn for silage, and sugar beet production. It is suited to wheat, barley, oats, and hay under dryfarm management. It is also suited to range. Capability units IIc-1 (irrigated), IIIc-1 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**68—Yamac loam, 2 to 4 percent slopes.** This is a gently sloping soil on alluvial fans and foot slopes. It has the profile described as typical of the series. Included in mapping are a few areas of soils that have a silt loam surface layer and clay loam subsoil and soils that have a few sandstone fragments throughout the profile. Small areas of Lonna soils are also included.

Surface runoff is slow or medium. The hazard of wind erosion is slight, and the hazard of water erosion is slight or moderate.

The soil is suited to wheat, barley, oats, and hay production under dryfarm management. Under irrigation, it is suited to wheat, barley, oats, hay, sugar beets, and corn for silage. It is also suited to range. Capability units IIe-4 (irrigated), IIIe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**69—Yamac loam, 4 to 8 percent slopes.** This is a moderately sloping soil on alluvial fans and foot slopes. Included in mapping are a few areas of soils that have a silt loam surface layer and clay loam subsoil and soils that have sandstone fragments throughout the profile. Small areas of Lonna soils and small areas of less sloping and more sloping soils are also included.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

This soil is suited to wheat, barley, and hay under dryfarm management. Under irrigation, it is suited to sugar beets, corn for silage, wheat, barley, oats, and hay. It is also suited to range. Capability units IIIe-2 (irrigated), IIIe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**70—Yamac loam, 8 to 15 percent slopes.** This is a strongly sloping soil on alluvial fans and foot slopes. Included in mapping are a few small areas of less sloping and steeper soils and soils that have a few sandstone fragments throughout the profile. Small areas of Lonna and Wayden soils are also included.

Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

This soil is suited to wheat and barley production under dryfarm management. It is also suited to range. Capability unit IVe-2 (dryland); Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Yawdim series

The Yawdim series consists of shallow, well drained soils that formed in material weathered from siltstone, loamstone, and shale. The Yawdim soils are on uplands at elevations of 4,000 to 4,500 feet and are underlain by weathered shale at depths of 10 to 20 inches. Slopes are 45 to 60 percent. The native vegetation was mainly western wheatgrass, needleandthread, green needlegrass, prairie junegrass, threadleaf sedge, annuals, and woody plants. The mean annual precipitation is 10 to 14 inches. The mean annual soil temperature is 45 to 47 degrees F. The frost-free season is 105 to 130 days.

In a representative profile the surface layer is light brownish gray clay loam 2 inches thick. The underlying material is 8 inches of light gray clay loam overlying gray shale.

Permeability is slow, and the available water capacity is very low. Reaction is strongly alkaline.

These soils are used mainly for range and wildlife.

Representative profile of Yawdim clay loam, in an area of Yawdim-Lambeth-Rock outcrop association, steep, 1,300 feet west and 70 feet south of northeast corner of section 16, T. 3 N., R. 20 E.

A1—0 to 2 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak thin platy structure that separates to weak fine granular; slightly hard, firm, sticky and plastic; many fine and very fine roots; violently effervescent; strongly alkaline; clear wavy boundary.

C1—2 to 10 inches; light gray (10YR 7/1) heavy clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, firm, sticky and plastic; many fine and very fine roots; violently effervescent; strongly alkaline; abrupt wavy boundary.

C2r—10 to 60 inches; gray shale; seams and threads of segregated lime and pockets of gypsum crystals between shale strata; few fine and very fine roots between fractures and shale strata.

The A horizon is 1 to 4 inches thick. Depth to bedrock is 10 to 20 inches. Reaction of the profile ranges from moderately alkaline to strongly alkaline.

**71—Yawdim-Lambeth-Rock outcrop association, steep.** This association consists of steep to very steep soils and rock outcroppings on uplands. About 35 percent is Yawdim clay loam that has 45 to 60 percent slopes and occupies the upper part of slopes and ridges. About 35 percent is Lambeth silt loam that has 25 to 50 percent slopes and occupies swales and the lower part of slopes. Rock outcrop makes up about 20 percent of the association and is mostly on the upper part of the slopes. Included in mapping and making up about 10 percent of the association are areas of Beenom, Cabba, and Tanna soils.

Surface runoff is rapid. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

These soils are used mainly for range. Yawdim and Lambeth soils in capability unit VIIe-1; windbreak suitability group 4; Yawdim soil in Shallow Clay range site, 10- to 14-inch precipitation zone, and Lambeth soil in Silty range site, 10- to 14-inch precipitation zone; Rock outcrop in capability class VIII, not assigned to a range site or windbreak suitability group.

# Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

The soils in the Stillwater County Area are used mostly for crops and range. Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

## Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each arable soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also

consider the detailed information given in the description of each soil.

About 30 percent of the acreage of the Stillwater County Area is used for crops and pasture. The main cultivated crops are wheat, barley, hay, sugar beets, and corn silage. The principal forage crops are alfalfa and grass. Soil tests indicate a need for fertilizer.

Salinity or alkalinity, caused by seepage water, is a major problem in the dryland crop areas. During fallow years, excess moisture filters downward in the soil beyond the root zone, dissolving the salts and carrying them into the ground water. The water moves laterally along an impermeable surface until it reaches a discharge area where the salt is deposited. Usually these saline areas are wet, but not ponded. Evaporation over long periods concentrates salts on the surface, thereby restricting plant growth. There are several alternative systems for controlling excess water: annual or continuous cropping, a two-third/one-third crop rotation, use of deep-rooted perennial crops, and drainage using tile or open ditches. The latest research data concerning improvement of seep-saline areas should be studied.

## Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

*Capability classes*, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

*Capability subclasses* are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability unit is identified in the description of each soil map unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

In the following pages the capability units in the Stillwater County Area are described and suggestions for the use and management of the soils are given. The irrigated units are described first, and then the dryland units.

*Capability unit IIe-1 (irrigated)*

This unit consists of deep, well drained soils. The surface layer is mostly loam or clay loam, and in some places it is gravelly loam. The underlying material is fine sand or very gravelly sand that generally starts at a depth of 20 to 40 inches. In some minor soils it is very gravelly sand that starts at a depth of 10 to 20 inches. These minor soils are droughty; they are mapped in a complex with the major soils. Slopes are 0 to 4 percent. The precipitation is 10 to 19 inches, and the growing season is 100 to 130 days.

These soils are moderately permeable in the surface layer and subsoil and moderately to very rapidly permeable in the underlying material. The available water capacity is moderate. The water and wind erosion hazard is slight or moderate. Surface runoff is slow or medium.

These soils are well suited to wheat, barley, oats, corn for silage, sugar beets, and hay. Wind and water erosion is a hazard if fields are left bare for long periods. Irrigation water is applied by sprinkler, furrow, and border methods.

Contour farming, planting field windbreaks, and leaving crop residue on the soil are methods of reducing erosion. Depth to fine sand or very gravelly sand is a limitation if fields are to be leveled. Cutting reduces the depth to this underlying material and reduces the available water-holding capacity. Applications of barnyard manure, nitrogen, and phosphorus are beneficial to crop establishment and crop vigor where the limy substratum is exposed by leveling.

*Capability unit IIe-2 (irrigated)*

Glendive fine sandy loam, 0 to 4 percent slopes, is the only soil in this unit. It is a deep, well drained soil. Slopes are 0 to 4 percent. The precipitation is 10 to 14 inches, and the growing season is 110 to 130 days. This soil is moderately rapidly permeable, and the available water capacity is moderate. The hazard of water and wind erosion is moderate. Surface runoff is slow.

This soil is well suited to wheat, oats, corn for silage, sugar beets, and hay. Wind and water erosion is a hazard if fields are left bare for long periods. Irrigation water is applied by sprinkler, furrow, and border methods.

Contour farming, planting field windbreaks, and leaving crop residue on the soil are methods of reducing erosion. Land leveling can improve water distribution where the soil surface is uneven. This soil is not permanently damaged by deep cutting during land leveling; however, additional management may be needed to reduce wind erosion if sandy layers are exposed by the leveling. Applications of barnyard manure, nitrogen, and phosphorus are beneficial to crop establishment and plant vigor where the limy substratum is exposed.

*Capability unit IIe-3 (irrigated)*

This unit consists of deep, well drained soils that have a clay loam or silty clay loam surface layer. Slopes are 0 to 4 percent. The precipitation is 10 to 19 inches, and the growing season is 90 to 130 days.

These soils are moderately permeable or moderately slowly permeable, and the available water capacity is moderate or high. The water erosion hazard is slight or moderate, and the wind erosion hazard is moderate. Surface runoff is slow or medium.

These soils are well suited to wheat, barley, oats, corn for silage, sugar beets, and hay. Wind and water erosion is a hazard if fields are left bare for long periods. Irrigation water is applied by sprinkler, furrow, and border methods.

Contour farming, using field windbreaks, and leaving crop residue on the ground are methods of reducing erosion. Water distribution where the soil surface is uneven can be improved by land leveling. These soils are not permanently damaged by deep cutting during land leveling; however, removing the surface layer increases the water erosion hazard. Timely farming and leaving crop residue on the ground are ways to maintain soil structure and organic-matter content and thereby maintain soil tilth and water infiltration. Applications of barnyard manure, nitrogen, and phosphorus are beneficial to crop establishment, plant vigor, and soil tilth where subsurface soil layers are exposed by land leveling.

*Capability unit IIe-4 (irrigated)*

This unit consists of deep, well drained soils that have a loam surface layer. Slopes are 2 to 4 percent. The precipitation is 10 to 14 inches, and the growing season is 105 to 130 days.

These soils are moderately permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight or moderate. Surface runoff is slow or medium.

These soils are well suited to wheat, barley, oats, corn for silage, sugar beets, and hay. Wind and water erosion is a hazard if fields are left bare for long periods. Irrigation water is applied by sprinkler, furrow, or border method.

Contour farming, planting field windbreaks, and leaving crop residue on the ground are methods of reducing erosion. Water distribution where the soil surface is uneven can be improved by land leveling. These soils are not permanently damaged by deep cutting if leveled. Applications of barnyard manure, nitrogen, and phosphorus are beneficial for crop establishment and for plant vigor, especially where a limy subsurface layer is exposed by land leveling.

*Capability unit IIw-1 (irrigated)*

This unit consists only of Attewan loam, seeped, 0 to 4 percent slopes. This soil is deep. It has a seasonal high water table at a depth of less than 20 inches during the growing season because of seepage from irrigation canals. The precipitation is 10 to 14 inches, and the growing season is 110 to 130 days.

This soil is moderately permeable in the surface layer, subsoil, and upper part of the underlying material. It is very rapidly permeable in the lower part of the underlying material. The available water capacity is moderate. The wind and water erosion hazard is slight. Surface runoff is slow.

This soil is suited to hay. Wheat, barley, oats, and corn for silage can be grown if water management practices are used to lower the seasonal high water table.

*Capability unit IIw-2 (irrigated)*

This unit consists of deep, well drained soils that have a fine sandy loam to clay loam surface layer. Slopes are 0 to 2 percent. These soils are occasionally flooded early in spring when ice jams form in the river and during peak periods of runoff from snowmelt in the spring. The

precipitation is 10 to 14 inches, and the growing season is 105 to 130 days.

These soils are moderately slowly permeable to moderately rapidly permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight. Surface runoff is slow.

These soils are well suited to wheat, barley, oats, corn for silage, sugar beets, and hay. The water erosion hazard is moderate or severe during periods of flooding. Irrigation water is applied by sprinkler, furrow, or border method.

Contour farming, terraces, diversions, grassed waterways, and leaving crop residue on the soil are effective ways to reduce water erosion during periods of flooding. Water distribution can be improved by land leveling. These soils are not permanently damaged by deep cutting during leveling. Timely farming is needed to maintain surface structure on the Harlem soil. Wind erosion needs to be controlled on the Glendive soil if sandy subsurface layers are exposed by land leveling. Applications of barnyard manure, nitrogen, and phosphorus are beneficial for crop establishment and plant vigor, especially where a limy subsurface layer is exposed.

*Capability unit IIs-1 (irrigated)*

This unit consists of deep, well drained soils that have a clay loam surface layer. Slopes are 0 to 2 percent. The precipitation is 10 to 19 inches, and the growing season is 100 to 130 days.

These soils are moderately slowly permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight. Surface runoff is slow.

These soils are well suited to wheat, barley, oats, and hay. Maintaining good soil tilth and water infiltration rates are the management needs in cropping these soils. They can be achieved by timely farming to maintain organic matter content. Irrigation water is applied by sprinkler, furrow, or border method.

Water distribution where the soil surface is uneven can be improved by land leveling. These soils are not permanently damaged by deep cutting if leveled. Applications of barnyard manure, nitrogen, and phosphorus are beneficial to crop establishment, plant vigor, and soil tilth where subsurface soil layers are exposed by land leveling.

*Capability unit IIc-1 (irrigated)*

This unit consists of deep, well drained soils that have a loam surface layer. Slopes are 0 to 2 percent. Precipitation is 10 to 14 inches, and the growing season is 105 to 130 days.

These soils are moderately permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight. Runoff is slow or medium.

These soils are well suited to wheat, barley, oats, corn for silage, sugar beets, and hay. The relatively short growing season is the only limitation. It restricts the kind of crops that can be grown to frost-tolerant species or short-season maturing hybrids. Water is applied to row crops by the furrow method and to small grain or hay crops by the border method. Sprinkler irrigation systems are also used to apply water.

Land leveling can improve water distribution where the soil surface is uneven. These soils are not permanently damaged by deep cutting during land leveling. Barnyard manure, nitrogen, and phosphorus are beneficial for crop establishment and for plant vigor, especially where a limy subsurface layer is exposed by land leveling.

*Capability unit IIIe-1 (irrigated)*

This unit consists of deep, well drained soils that have a loam to silty clay loam surface layer. Some soils have gravelly loam underlying material. Slopes are 2 to 8 percent. The precipitation is 10 to 19 inches, and the growing season is 90 to 130 days.

These soils are moderately or moderately slowly permeable, and the available water capacity is moderate or high. The water erosion hazard is moderate, and the wind erosion hazard is slight or moderate. Surface runoff is medium.

These soils are suited to wheat, barley, oats, corn for silage, sugar beets, and hay. Wind and water erosion is a hazard if fields are left bare for long periods. Irrigation water is applied by sprinklers or gravity flow from ditches. Contour farming, field windbreaks, and leaving crop residue on the soil help reduce erosion. Maintaining good soil tilth and water infiltration rates are management needs in cropping these soils. Timely farming to maintain surface soil structure and leaving crop residue on the surface to maintain the organic-matter content are effective ways to improve soil tilth. Applications of barnyard manure, nitrogen, and phosphorus are beneficial to crop establishment and plant vigor.

*Capability unit IIIe-2 (irrigated)*

This unit consists of deep, well drained soils that have a loam, clay loam, or silty clay loam surface layer. Slopes are 0 to 8 percent. The precipitation is 10 to 14 inches, and the growing season is 105 to 120 days.

These soils are moderately permeable, and the available water capacity is moderate or high. The water erosion hazard is slight or moderate, and the wind erosion hazard is moderate. Surface runoff is slow or medium.

These soils are suited to wheat, barley, oats, corn for silage, sugar beets, and hay. Wind and water erosion is a hazard if fields are left bare for long periods. Irrigation water is applied by sprinklers or by gravity flow from ditches.

Contour farming, field windbreaks, and leaving crop residue on the surface are methods of reducing erosion. Applications of barnyard manure, nitrogen, and phosphorus are beneficial to crop establishment and plant vigor.

*Capability unit IIIe-3 (irrigated)*

Turner clay loam, 4 to 8 percent slopes, is the only soil in this unit. It is a deep, well drained soil that has a clay loam surface layer. This soil has very gravelly sand at a depth of 20 to 40 inches. Slopes are 4 to 8 percent. The precipitation is 15 to 19 inches, and the growing season is 100 to 120 days.

This soil is moderately permeable in the surface layer, subsoil, and upper part of the underlying material and is rapidly permeable in the lower part of the underlying material. The available water capacity is moderate. The water and wind erosion hazard is moderate. Surface runoff is medium.

This soil is suited to wheat, barley, oats, and hay. Wind and water erosion is a hazard if fields are left bare for long periods. Irrigation water is applied by sprinklers or by gravity flow from ditches.

Contour farming, field windbreaks, and leaving crop residue on the ground are methods of reducing erosion. Depth to very gravelly sand is a limitation if fields are to be reshaped. Cutting reduces the depth to this underlying material and reduces the available water-holding capacity. Applications of barnyard manure, nitrogen, and phosphorus are beneficial to crop establishment and crop vigor.

*Capability unit IVe-1 (irrigated)*

The Lolo complex, 0 to 4 percent slopes, is the only map unit in this capability unit. It consists of deep, well drained soils that have a gravelly loam, cobbly loam, or, in some places, a stony loam surface layer. The precipitation is 15 to 19 inches, and the growing season is 100 to 130 days.

These soils have moderately rapid permeability, and the available water capacity is low or moderate. The water erosion hazard is slight and the wind erosion hazard is moderate. Runoff is slow.

The soils of this complex are suited to hay and range. The relatively short 110- to 130-day growing season, low or moderate available water holding capacity, the gravelly and cobbly surface layer of the Lolo soils, and the stony surface layer of the other soils in the complex are the major limitations. These limitations greatly restrict the kinds of crops that can be grown. Sprinkler and border systems of irrigation are the most practical systems used to apply water.

Barnyard manure, nitrogen, and phosphorus are beneficial for crop establishment and for plant vigor.

*Capability unit VIw-1 (irrigated)*

This unit consists of deep, well drained soils that have a gravelly loam or very gravelly loam surface layer. These soils are flooded early in spring when ice jams form in the river and during peak periods of runoff from snowmelt. They may also flood after heavy rainfall. Slopes are 0 to 2 percent. The precipitation is 15 to 19 inches, and the growing season is 100 to 130 days.

These soils are moderately rapidly to very rapidly permeable, and the available water capacity is very low. The water and wind erosion hazard is slight. Surface runoff is slow.

These soils are suited to hay. They are not suited to cultivated crops because of the severe water erosion hazard during periods of flooding.

*Capability unit IIIe-1 (dryland)*

This unit consists of moderately deep, well drained soils that have mostly a loam or clay loam surface layer. These soils are underlain by bedrock at a depth of 20 to 40 inches. Some soils have a channery loam or very channery loam surface layer. In this unit are some shallow soils that are mapped in a complex with the major soils. These soils are droughty and are underlain by bedrock at a depth of 10 to 20 inches. Slopes are 2 to 8 percent. The precipitation is 10 to 19 inches, and the growing season is 90 to 120 days.

These soils are moderately to slowly permeable, and the available water capacity is low or very low. The water erosion hazard is moderate, and the wind erosion hazard is slight or moderate. Surface runoff is medium.

These soils are suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. Wind and water erosion is a hazard if fields are left bare for prolonged periods of time. Stripcropping, stubble-mulch tillage, field windbreaks, and tall wheatgrass barriers are effective in reducing wind erosion.

Contour farming, terraces, stubble-mulch tillage, and grassed waterways help to reduce water erosion. These practices, used either individually or in combination, are effective in reducing soil erosion. The low or very low available water-holding capacity and restricted rooting depth are limitations to growing crops. Special management is required when excess moisture is added to the ground water, creating a potential recharge area for saline seeps. Special cropping systems are required to balance stored moisture and moisture used by crops.

*Capability unit IIIe-2 (dryland)*

This unit consists of mostly deep, well drained soils that have a loam to silty clay loam surface layer and some moderately deep soils that are mapped in a complex with the major soils. These soils are underlain by bedrock at a depth of 20 to 40 inches. Slopes are 0 to 8 percent. The precipitation is 10 to 19 inches, and the growing season is 90 to 130 days.

These soils are moderately permeable or moderately slowly permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight or moderate. Surface runoff is slow or medium.

These soils are suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. Wind and water erosion is a hazard if fields are left bare for long periods. Stripcropping, stubble-mulch tillage, field windbreaks, and tall wheatgrass barriers are

effective in reducing wind erosion. Contour farming, terraces, stubble mulch tillage, and grassed waterways help control runoff. These practices can be used either individually or in combination to reduce soil erosion.

*Capability unit IIIe-3 (dryland)*

This unit consists of deep, well drained soils that have a loam or clay loam surface layer. Some soils have gravelly loam underlying material. Slopes are 0 to 8 percent. The precipitation is 10 to 19 inches, and the growing season is 90 to 130 days.

These soils are moderately slowly permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight or moderate. Surface runoff is slow or medium.

These soils are suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. Wind and water erosion is a hazard if fields are left bare for long periods. Stripcropping, stubble-mulch tillage, field windbreaks, and tall wheatgrass barriers are effective in reducing wind erosion.

Contour farming, terraces, stubble-mulch tillage, and grassed waterways help control runoff. These practices can be used either individually or in combination to reduce soil erosion. Special management required to maintain good soil tilth consists of timely farming to maintain surface structure, and stubble-mulch tillage to maintain organic-matter content.

*Capability unit IIIe-4 (dryland)*

Turner clay loam, 4 to 8 percent slopes, is the only soil in this unit. It is a deep, well drained soil that has a clay loam surface layer and very gravelly sand underlying material at a depth of 20 to 40 inches. Slopes are 4 to 8 percent. The precipitation is 15 to 19 inches, and the growing season is 100 to 120 days.

This soil is moderately permeable in the surface layer, subsoil, and upper part of the underlying material and rapidly permeable in the lower part of the underlying material. The available water capacity is moderate. The water and wind erosion hazard is moderate. Surface runoff is medium.

This soil is suited to wheat, barley, and oats in a crop-fallow system. It is also suited to hay and range. Wind and water erosion is a hazard if fields are left bare for prolonged periods. Stripcropping, stubble-mulch tillage, field windbreaks, and tall wheatgrass barriers are effective in reducing wind erosion.

Contour farming, terraces, stubble-mulch tillage, and grassed waterways help control runoff. These practices can be used either individually or in combination. The moderate available water-holding capacity of this soil is another limitation for growing crops. Stripcropping, stubble-mulch tillage, field windbreaks, tall wheatgrass barriers, contour farming, and terraces help to conserve moisture.

*Capability unit IIIw-1 (dryland)*

This unit consists of deep, well drained soils that have a clay loam or loam surface layer. Slopes are 0 to 2 percent. These soils are occasionally flooded early in spring when ice jams form in the river and during peak periods of runoff from snowmelt in the spring. The precipitation is 10 to 14 inches, and the growing season is 105 to 130 days.

These soils are moderately slowly or moderately permeable, and the available water capacity is moderate or high. The water erosion hazard is slight, and the wind erosion hazard is slight. Surface runoff is slow.

These soils are well suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. The water erosion hazard may be severe during periods of flooding. Terraces, diversions, stubble-mulch tillage, and grassed waterways are effective in reducing water erosion during periods of flooding.

*Capability unit IIIs-1 (dryland)*

This unit consists of deep, well drained soils that have mostly a loam or clay loam surface layer and some that have a gravelly loam surface layer. Slopes are 0 to 4 percent. The precipitation is 10 to 19 inches, and the growing season is 100 to 130 days.

The soils are moderately permeable in the surface layer and subsoil and moderately to very rapidly permeable in the underlying material. The available water capacity is mostly moderate, but in some soils it is very low. The water and wind erosion hazard is slight or moderate. Surface runoff is slow or medium.

The soils are well suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. The available water-holding capacity is the major limitation to use of these soils for crops. Contour farming, terraces, stubble-mulch tillage, stripcropping, field windbreaks, and tall wheatgrass barriers help to conserve moisture.

*Capability unit IIIs-2 (dryland)*

This unit consists of deep, well drained soils that have a clay loam surface layer. Slopes are 0 to 2 percent. The precipitation is 10 to 19 inches, and the growing season is 100 to 130 days.

The soils are moderately slowly permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight. Surface runoff is slow.

The soils are well suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. Maintaining good soil tilth and water infiltration rates are management needs when cropping these soils. They are achieved by timely farming to maintain surface soil structure and stubble-mulch tillage to maintain organic-matter content.

*Capability unit IIIc-1 (dryland)*

This unit consists of deep, well drained soils that have a loam surface layer. Slopes are 0 to 2 percent. The precipitation is 10 to 14 inches, and the growing season is 105 to 130 days.

These soils are moderately permeable, and the available water capacity is moderate or high. The water and wind erosion hazard is slight. Surface runoff is slow or medium.

These soils are suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. Low precipitation is the primary management limitation. With added moisture these soils could be cropped annually. Stripcropping, leaving crop residue on the surface, and planting field windbreaks and tall wheatgrass barriers help to conserve moisture. They also aid in trapping drifting snow, thus increasing the available moisture.

*Capability unit IVe-1 (dryland)*

This unit consists of moderately deep, well drained soils that have mostly a loam or clay loam surface layer. These soils are underlain by bedrock at a depth of 20 to 40 inches. Some soils have a channery loam or very channery loam surface layer. Some shallow soils that are mapped in a complex with the major soils are droughty and are underlain by bedrock at a depth of 10 to 20 inches. Slopes are 2 to 15 percent. The precipitation is 10 to 19 inches, and the growing season is 100 to 120 days.

These soils are mostly moderately slowly permeable to very slowly permeable and have a low available water capacity. Some soils are moderately rapidly permeable and some have a moderate available water capacity. The water erosion hazard is moderate, and the wind erosion hazard is slight. Surface runoff is medium.

These soils are suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. Wind erosion and water erosion are hazards if fields are left bare for long periods. Stripcropping, stubble-mulch tillage, field windbreaks, and tall wheatgrass barriers are effective in reducing soil blowing. Contour farming, terraces, stubble-mulch tillage, and grassed waterways help reduce erosion from runoff. These practices can be used in combination. The low and very low available water-holding capacity and restricted rooting depth are limitations for crops. Special management is required if excess moisture is added to ground water, creating a potential recharge area for saline seeps. Special cropping systems are required to balance stored moisture and moisture used by crops. Well managed hay and range systems that provide a permanent vegetative cover can adequately reduce surface runoff and wind erosion.

*Capability unit IVe-2 (dryland)*

This unit consists mainly of deep, well drained soils that have a fine sandy loam to clay loam surface layer. Some shallow soils that are mapped in a complex with the major soils are underlain by bedrock at a depth of 10 to 20 inches. Some soils have gravelly loam underlying material. Slopes are 0 to 15 percent. The precipitation is 10 to 19 inches, and the growing season is 100 to 130 days.

These soils are mostly moderately rapidly permeable to moderately slowly permeable and have moderate or high available water capacity. The slowly permeable soils that are mapped in complex with the major soils have a very low available water capacity. The water erosion hazard is moderate or severe, and the wind erosion hazard is slight to severe. Surface runoff is slow or medium.

These soils are suited to wheat, barley, and oats in a crop-fallow system. They are also suited to hay and range. Wind erosion and water erosion are hazards if fields are left bare for prolonged periods. Stripcropping, stubble-mulch tillage, field windbreaks, and tall wheatgrass barriers are effective in reducing soil erosion. Contour farming, terraces, stubble-mulch tillage, and grassed waterways are ways to reduce erosion from water runoff. These practices can be used in combination. Well managed hay and range systems that provide a permanent vegetative cover can adequately reduce surface runoff and wind erosion.

*Capability unit IVe-3 (dryland)*

Turner stony clay loam, 4 to 15 percent slopes, is the only soil in this unit. It is a deep, well drained soil that has a stony clay loam surface layer. It has very cobbly sand underlying material at a depth of 20 to 40 inches. Slopes are 4 to 15 percent. The precipitation is 15 to 19 inches, and the growing season is 100 to 120 days.

This soil is moderately permeable in the surface layer, subsoil, and upper part of the underlying material and is rapidly permeable in the lower part of the underlying material. The available water capacity is moderate. The water erosion hazard is moderate, and the wind erosion hazard is slight. Surface runoff is medium.

This soil is well suited to range. It is suited to wheat and barley if the stones are removed.

*Capability unit IVw-1 (dryland)*

Glendive fine sandy loam, occasionally flooded, is the only soil in this unit. It is a deep, well drained soil that has a fine sandy loam surface layer. Slopes are 0 to 2 percent. This soil is occasionally flooded early in spring when ice jams form in the river and during peak periods of runoff from snowmelt in the spring. The precipitation is 10 to 14 inches, and the growing season is 110 to 130 days.

This soil is moderately rapidly permeable, and the available water capacity is moderate. The water erosion hazard is slight to severe, and the wind erosion hazard is moderate. Surface runoff is slow.

This soil is well suited to barley and oats in a crop-fallow system. It is also suited to hay and range. The water erosion hazard may be severe during periods of flooding. Terraces, diversions, stubble-mulch tillage, and grassed waterways are effective in reducing water erosion during

periods of flooding. Well managed hay and range systems that provide a permanent vegetative cover can adequately reduce water erosion.

*Capability unit VIe-1 (dryland)*

This unit consists mostly of shallow or moderately deep, well drained soils that have a clay loam or loam surface layer. These soils are underlain by bedrock at a depth of 10 to 40 inches. Some soils have a channery loam or stony loam surface layer. Some soils are deep and have underlying material extending to a depth of 60 inches. Slopes are 4 to 50 percent. The precipitation is 10 to 20 inches, and the growing season is 60 to 120 days.

The soils are mostly moderately permeable or moderately slowly permeable and are low or very low in available water capacity. Some soils are moderately rapidly permeable. The water erosion hazard is slight to severe, and the wind erosion hazard is slight. Surface runoff is medium to rapid.

The soils are suited to range. The Sebud soils in this unit are suited to hay production if the stones are removed. These soils are not suitable for cultivated crops because they are steep and stony and have low available water-holding capacity. See the section "Use of the soils for range" for range site descriptions and management needs of these soils.

*Capability unit VIw-1 (dryland)*

This unit consists of the Ustifluvents part of Ustifluvents-Fluvaquents, flooded. These are deep, well drained to poorly drained soils that have a sandy loam to silty clay surface layer. Some soils have sand and gravel at a depth of 20 to 40 inches. Some soils have a water table at or near the surface. These soils are flooded in the spring from snowmelt or from ice jams that form late in winter. The precipitation is 10 to 14 inches, and the growing season is 100 to 130 days.

These soils are slowly permeable to moderately permeable, and the available water capacity is moderate or high. The water erosion hazard is severe, and the wind erosion hazard is slight.

These soils are suited mainly to range. They are not suited to cultivated crops because of periodic flooding, high erosion hazard, and high water table. See the section "Use of the soils for range" for range site descriptions and management needs of these soils. See the section "Descriptions of the soils" for the woodland descriptions and management needs of the Ustifluvents-Fluvaquents association.

*Capability unit VIs-1 (dryland)*

This unit consists of deep, well drained soils that have a silty clay loam, gravelly loam, or very gravelly loam surface layer. Slopes are 0 to 8 percent. The precipitation is 10 to 19 inches, and the growing season is 100 to 130 days.

These soils are mostly moderately permeable to very rapidly permeable, and the available water capacity is mostly very low. Some soils are very slowly permeable and have moderate or high available water capacity. The water erosion hazard is slight, and the wind erosion hazard is slight or moderate. Surface runoff is slow or medium.

These soils are suited mainly to range; Lolo soils are suited to hay. These soils are not suited to cultivated crops because of their very low available water capacity or alkaline layers. See the section "Use of the soils for range" for range site descriptions and management needs.

*Capability unit VIIe-1 (dryland)*

This unit consists of shallow to deep, well drained soils that have a surface layer of loam to clay loam or gravelly sandy loam to stony loam. Some soils have hard or soft bedrock at a depth of 10 to 40 inches. Slopes are 15 to 75 percent. The precipitation is 10 to 24 inches, and the growing season is 60 to 130 days.

These soils are slowly permeable to moderately rapidly permeable, and the available water capacity is very low to high. The water erosion hazard is severe, and the wind erosion hazard is slight. Surface runoff is rapid.

These soils are used mostly for range and wildlife. The Garlet, Sebud, and Winkler soils are used for timber production and wildlife. These soils are not suited to cultivated crops because of steep slopes. See the section "Use of the soils for range" for range site descriptions and management needs of the grassland soils. See "Description of the soils" for management needs of the woodland soils.

*Capability unit VIIw-1 (dryland)*

McKenzie clay, saline, is the only soil in this unit. It is a deep, poorly drained, saline soil that has a clay surface layer. Slopes are 0 to 2 percent. The precipitation is 10 to 14 inches, and the growing season is 110 to 120 days.

The soil is very slowly permeable, and the available water capacity is moderate or high. The water erosion hazard is slight, and the wind erosion hazard is moderate. Surface runoff is very slow.

The soil is suited to range. It is not suited to cultivated crops because of the high water table and saline layers. See the section "Use of the soils for range" for range site descriptions and management needs of this soil.

*Capability unit VIIs-1 (dryland)*

Lardell clay loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained or poorly drained soil that has a clay loam surface layer. Slopes are 0 to 2 percent. The precipitation is 10 to 14 inches, and the growing season is 110 to 120 days.

The soil is slowly permeable, and the available water capacity is moderate. The water and wind erosion hazards are slight. Surface runoff is slow.

The soil is suited to range. It is not suited to cultivated crops because of the saline layers. See the section "Use of the soils for range" for range site descriptions and management needs of this soil.

*Capability class VIII (dryland)*

This unit consists of nearly barren sandstone and shale outcrops mapped in association with other soils. These areas provide some cover for wildlife but have no practical value for domestic livestock grazing.

## Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 2. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 2.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 2 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

## Use of the soils for woodland

THIS SECTION WAS WRITTEN BY HAROLD E. HUNTER, forester, Soil Conservation Service, Bozeman, Montana.

About 62,000 acres in the survey area is forested. Of this acreage 40,000 acres is commercial forest. Nearly all of the forested land is in private ownership and 90 percent of it is grazed.

The predominant forest type is ponderosa pine, and it occurs across the county. It occurs on the rougher landscapes within the area and sometimes is intermingled with grass on nearly level to sloping benchlands. In the Granite Mountain Range at the southwest end of the county ponderosa pine merges with lodgepole pine and Douglas-fir at the higher elevations. The quaking aspen forest type is not extensive, but it is commonly intermixed with lodgepole pine and Douglas-fir at the lower elevations. About 4,000 acres of cottonwood, primarily plains cottonwood, occurs within the survey area on soils of the stream flood plains.

Many of the softwood stands of trees are 80 to 90 years old and are nearing maturity. Cottonwood and aspen stands are generally 40 to 70 years old and are mature. The forest productivity of about 30,000 acres of commercial forest can be increased through thinning and the harvest of mature and diseased trees. Forage yields of the understory plants can be increased on about half of the forest acreage, which will benefit livestock and wildlife production.

There is no formal organization to provide fire protection on private forest lands outside the National Forest boundary. Insect and disease control on private lands is essentially the responsibility of the private landowners. Technical assistance to the private landowner concerned with insect and disease control is available from the Division of Forestry.

There are no known insect or disease epidemics in the area, but endemic infestations of insects and disease affect the growth, quality, and condition of stands. Dwarf mistletoe is prevalent throughout stands of lodgepole pine and Douglas-fir. Spruce budworm affects the growth and quality of Douglas-fir. Pine bark beetles attack primarily stands of ponderosa pine, particularly where slash has been allowed to accumulate. In some areas, porcupine seriously affects the quality and growth of timber, especially in stands of ponderosa pine.

A portable sawmill is operating within the survey area and processing approximately 500,000 board feet of lumber per year. A post and pole plant is also in operation. Currently, there is not a heavy demand for timber within the area.

Intensive forest management is becoming a reality as a result of conservation programs, an expanding market, and educational work by public and private foresters.

To aid those who manage forest land in the Stillwater County Area, soil interpretations relating to woodland use and management have been developed. Items considered for interpretation are: timber productivity, erosion hazard, equipment limitations, plant competition, seedling mortality, windthrow hazard, applicable silvicultural systems, species suitability and yield, and kinds of understory plants.

Woodland management information for each forested soil is contained in the map unit descriptions in the section "Description of the soils." Following is a list of the map units that support a forest resource: 15*—Birney-Yawdim-Rock outcrop association, steep; 18*—Garlet-Sebud association, very steep; 20—Glendive fine sandy loam, occasionally flooded; 38*—Lolo and Nesda soils, flooded; 52—Shawa silty clay loam, 0 to 8 perent slopes; 61—Ustifluvents-Fluvaquents association, flooded; 64*—Winkler-Hilger-Rock outcrop association, steep.

Woodland interpretation terms are defined in the following paragraphs.

The *potential productivity* of merchantable or important trees on a soil is expressed as a site index. Site index is the average height, in feet, attained by the dominant and codominant trees of a given species in a specified number of years—30 for cottonwood, 50 for Douglas-fir, 80 for quaking aspen, and 100 years for lodgepole pine and ponderosa pine. Site index values can be related to yield tables to determine potential board-foot or cubic-foot volumes (yield) of timber per acre. The species for which yield and site index calculations were made in each map unit were generally the most common species and the most desirable to manage from a timber production point of view.

Site index values for narrowleaf and plains cottonwood were determined by adjusting site index curves for eastern cottonwood. The site index curves for eastern cottonwood were developed from several sources (*3*). Gross board-foot volume per acre was determined by on-the-ground measurements taken during the soil survey. In determining board-foot volumes, 8-foot logs down to an 8-inch top diameter were measured. Cubic volume per acre was determined by applying a conversion factor of 5.2 board feet per cubic foot. Cubic volume includes the entire tree exclusive of bark and twigs.

Yields for quaking aspen were estimated from the publication "The Growth and Yield of Aspen in Saskatchewan" (*4*). Cubic-foot volume is based on the entire stem inside bark.

Site index values and wood volume per acre for ponderosa pine were calculated from data in "Yield of Even-Aged Stands of Ponderosa Pine" (*5*). The board-foot volume per acre is based on the Scribner log rule. All trees more than 6.6 inches in diameter at breast height (4.5 feet) to a 6-inch diameter (inside bark) top were included in the calculations. Cubic-foot volumes are calculated for all trees 6.6 inches and more in diameter, including stump and tip but not bark.

Site index values for lodgepole pine and board-foot and cubic-foot volumes were calculated from information in Forest Service research papers from the Rocky Mountain Forest and Range Experiment Station in Fort Collins, Colorado. The board-foot volume per acre is based on the Scribner log rule. All trees larger than 10 inches in diameter at breast height to an 8-inch top diameter (inside bark) were included in the calculations. Cubic-foot volume is based on measurements of all trees more than 4.5 feet tall from ground line to tip exclusive of bark.

*Erosion hazard* is an assessment of the degree of potential soil loss in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soils.

In this survey, evaluations were made on the basis of clearcut areas where slash had been burned and reasonable care was used in logging to prevent funneling of skid trails to concentrate water.

Ratings of *equipment limitations* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

*Seedling mortality* ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless

the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

*Suitable species* are those that are suitable for commercial wood production and that are suited to the soils.

*Silvicultural system* refers to methods of harvesting that provide for the regeneration of desirable tree species, develop a desirable stand structure, and aid in insect and disease control. The selection of a silvicultural system is determined by the kinds of trees a given soil supports, management objectives, and condition of the stands. The silvicultural systems are recommended on the basis of regenerating stands of desirable timber-producing species where disease or insect infestations are not a limitation.

The selection system involves the removal of mature and immature trees either singly or in groups at intervals. Regeneration is established almost continuously, and an uneven aged stand is maintained. Ths system favors the regeneration of the more tolerant of associated trees.

The shelterwood system involves removing the stand in a series of cuts. Regeneration occurs under a partial forest canopy. After regeneration is established, a final harvest cut removes the shelterwood and permits the stand to develop in the open as an even-aged stand. This system is well adapted to sites where shelter is needed for new reproduction, and it can be used to favor regeneration of the more intolerant species in a forest stand.

The seed-tree system involves harvesting nearly all timber in a selected area in one cut. A few of the better trees are left distributed over the area to provide seed. They may or may not be harvested after regeneration is established.

In the clearcut system, all the trees in an area are removed in one cut. Natural regeneration is dependent on seed left from the crowns of harvest trees, seedlings already established, or windblown seed from the surrounding forest. This system is often used in an attempt to establish young healthy stands in areas of diseased, overmature, and dying or insect-killed trees.

*Yield of understory plants* is the air-dry weight of the annual growth of understory plants up to the height that grazing animals can reach. Yield is determined not only by soils and the climatic variation within the area in which a soil occurs, but by the canopy density of the trees. Yield values are given for three different levels of tree canopy density. An assessment of the amount of yield that is potential feed for all grazing animals is made, and the more desirable forage plants are identified.

## Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Windbreaks, to be successful, need to be planned. Location, selection, and arrangement of species within the windbreak and provisions for weed control are all important.

Soils need to be considered in selecting trees and shrubs for windbreaks. Not all windbreak species will grow on all soils. For example, cottonwoods or willows will not grow on droughty, very gravelly, or shallow sandy soils. Caragana will not survive on soils that are saturated with water for more than 2 weeks.

Soils in the Stillwater County Area are placed into windbreak suitability groups on the basis of similar performance or degree of the hazards and limitations if the soils are used for trees and shrubs. Factors considered in developing the windbreak suitability groups are: climate, available water capacity, depth to a layer of concentrated lime in the soil, soil salinity and alkalinity, degree of wetness, and soil slope. Each of the windbreak suitability groups is described in this section and examples of common adapted tree and shrub species are listed for each of the groups.

For assistance in selecting adapted trees and shrubs and in designing windbreaks, contact the local Conservation District, Soil Conservation Service, or Extension Service representatives.

### *Windbreak suitability group 1*

This group consists of deep, well drained soils that have only slight limitations. The surface layer is clay loam, loam, silt loam, or silty clay loam. Slopes are 0 to 15 percent. The available water capacity is moderate or high and permeability is moderate. The annual precipitation is 10 to 19 inches.

Trees and shrubs suitable for planting on irrigated or dryland soils in this group include honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, buffaloberry, sandcherry, cotoneaster, dogwood, Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow,

golden willow, cottonwood, ponderosa pine, Scotch pine, blue spruce, and Rocky Mountain juniper.

*Windbreak suitability group 2M*

This group consists of deep, well drained soils that have a seasonal water table at a depth of more than 60 inches. The available water capacity is moderate, and permeability is moderate. The surface layer is clay loam, fine sandy loam, loam, or stony clay loam. Some soils have loose very gravelly sand at a depth of 20 to 40 inches, and in this layer the permeability is rapid. Slopes are 0 to 15 percent. The annual precipitation is 10 to 19 inches.

Trees and shrubs suitable for planting on irrigated or dryland soils in this group include honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, buffaloberry, sandcherry, cotoneaster, dogwood, Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, golden willow, cottonwood, ponderosa pine, Scotch pine, blue spruce, and Rocky Mountain juniper.

*Windbreak suitability group 3M*

This group consists of moderately deep, well drained soils that have a loam or clay loam surface layer. The available water capacity is low and permeability is moderate to very slow. Depth to bedrock ranges from 20 to 40 inches. Slopes are 2 to 15 percent. Annual precipitation is 10 to 19 inches.

Trees and shrubs suitable for planting on dryland soils in this group are caragana, skunkbush sumac, buffaloberry, sandcherry, Russian-olive, Siberian crabapple, Siberian elm, ponderosa pine, and Rocky Mountain juniper.

*Windbreak suitability group 3W*

Attewan loam, seeped, 0 to 4 percent slopes, is the only soil in this group. This soil is deep and has a seasonal water table at a depth of 20 inches or less during the irrigation season. The available water capacity is high and permeability is moderate. The annual precipitation is 10 to 14 inches.

Trees and shrubs suitable for planting on irrigated or dryland areas of this soil include honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, buffaloberry, sandcherry, cotoneaster, dogwood, Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, golden willow, cottonwood, ponderosa pine, Scotch pine, blue spruce, and Rocky Mountain juniper.

*Windbreak suitability group 3S*

Absher silty clay loam, 0 to 6 percent slopes, is the only soil in this group. This soil is deep and well drained and is strongly alkaline below a depth of 5 inches. The available water capacity is moderate or high, and permeability is very slow. The annual precipitation is 10 to 14 inches.

Trees and shrubs suitable for planting on dryland are caragana, honeysuckle, lilac, chokecherry, skunkbush sumac, sandcherry, Nanking cherry, Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, Rocky Mountain juniper, and Scotch pine.

*Windbreak suitability group 4*

This group consists of shallow and moderately deep, well drained soils. The surface layer ranges from gravelly sandy loam to clay. Slopes are 0 to 60 percent. The available water capacity is moderate to very low. The soils are mostly 20 to 40 inches deep to bedrock; the shallower soils are 10 to 20 inches deep. Some soils have salts in the surface layer; some are heavy dispersed clays. The annual precipitation is 10 to 19 inches.

Only the hardiest trees and shrubs grow on the soils of this group. Suitable species for planting are caragana, skunkbush sumac, sandcherry, Nanking cherry, Russian-olive, Siberian crabapple, Siberian elm, ponderosa pine, Rocky Mountain juniper, and Scotch pine.

## Use of the soils for range

DONALD W. MESSER, range conservationist, Soil Conservation Service, helped write this section.

About 70 percent of the acreage in the Stillwater County Area is used for range. The main vegetation consists of mid and tall grasses, forbs, and shrubs. In some areas, stands of ponderosa pine are too thin to be classified as woodland. Such areas are included in a range site.

Soils that have the capacity to produce the same kinds, amounts, and proportions of range plants are grouped into range sites. A range site is the product of all environmental factors responsible for its development.

A plant community existing within a range site that has not undergone abnormal disturbance is the potential, or climax, plant community for that site. Climax plant communities are not precise or fixed in their composition but vary, within reasonable limits, from year to year and from place to place.

Abnormal disturbance such as overuse by livestock, excessive burning, erosion, or plowing results in changes in the climax plant community or even in its complete destruction if the disturbance is drastic enough. If the range site has not deteriorated significantly under such disturbance, secondary plant succession progresses in the direction of the natural potential plant community for the site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range site is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

If changes occur in the climax plant community because of use by livestock or disturbance, some plant species will increase and others will decrease. The increase or decrease depends on the grazing animal, season of use,

and the degree of utilization. By comparing the composition of the present plant community to the potential plant community, it is possible to see how individual species have increased and others have decreased. Plants not present in the climax community which show up in the present plant community are invaders for the site.

The composition of climax and present plant communities, together with other range site information, provides the basis for selecting range management systems.

Management programs generally try to increase desirable plants and restore rangeland to as near climax condition as possible. Some programs are designed to create or maintain a plant community somewhat removed from the climax to fit specific needs in the grazing program, to provide for wildlife habitat, or for other benefits. Any management objective should be compatible with conservation objectives.

In the following pages, the 15 range sites in the Stillwater County Area are briefly described and the climax plants and principal invaders on the sites are named. The potential annual yield is estimated—for range in excellent condition, unless otherwise identified—for favorable and unfavorable seasons. These yields are given as the normal high and low rather than the extremes. Yields are the total annual yield in pounds of air-dry herbage per acre, which includes the current year's growth of leaves, stems, twigs, and fruit of all plants on the site. Not all of this herbage is usable by livestock.

*Subirrigated range site*

This range site consists of deep, well drained soils on fans and terraces. Slopes are 0 to 4 percent. The soils mainly have a loam surface layer and underlying material of loam or clay loam. Some soils have gravelly underlying material. Permeability is moderate. Some areas that have less rainfall than the rest receive seepage from irrigation canals. In some areas near streams, the water table is controlled by the level of the streamflow.

The approximate species composition, by percentage of total weight, of the climax (potential) plant community is 15 percent each of prairie cordgrass, tufted hairgrass, basin wildrye, and tall reedgrasses; 10 percent each of western wheatgrass, sedges, and perennial forbs; and 5 percent each of meadow foxtail and woody plants.

This range site in excellent condition produces about 2,200 pounds per acre of air-dry herbage in years of favorable moisture and 1,800 pounds per acre in years of unfavorable moisture. Approximately 99 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, prairie cordgrass and tall reedgrasses decrease. Western wheatgrass, low sedges, mat muhly, shrubby cinquefoil, and weedy forbs increase. If overgrazing continues, Kentucky bluegrass, broom snakeweed, curlycup gumweed, annuals, biennials, and noxious weeds invade the site.

Livestock are attracted to this site because vegetation stays green on it longer than on adjacent sites. It is advisable to fence areas that are large enough to justify the expense. Management practices are needed that maintain or improve the vegetative cover, mulch, and soil structure; that control erosion and pollution; and that produce the maximum amount of native forage.

*Saline Lowland range site (10- to 14-inch precipitation zone)*

This range site consists of deep, somewhat poorly drained and poorly drained soils on alluvial fans and in closed basins. Slopes are 0 to 4 percent. The soils have a clay loam or clay surface layer. Permeability is slow or very slow. These soils are very saline, and some have salt crusts.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is as follows: alkali sacaton, 20 percent; Nuttall saltgrass, alkali cordgrass, and basin wildrye, 15 percent each; inland saltgrass and perennial forbs, 10 percent each; and slender wheatgrass, western wheatgrass, and greasewood, 5 percent each.

This range site in excellent condition produces approximately 3,500 pounds per acre of air-dry herbage in years of favorable moisture, and 2,500 pounds per acre in years of unfavorable moisture. Approximately 90 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, alkali cordgrass, alkali sacaton, and basin wildrye decrease. Western wheatgrass, saltgrass, squirrel tail, mat muhly, and greasewood increase. If overgrazing continues, foxtail barley, broom snakeweed, Russian thistle, seepweed, and annuals invade the site.

Proper grazing is more difficult to obtain on this site than on adjacent sites, because this site stays green longer. Management practices are needed to maintain or improve the vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Sandy range site (10- to 14-inch precipitation zone)*

This range site consists of deep, well drained soils on foot slopes, stream terraces, and uplands. Slopes are 0 to 15 percent. The soils have a fine sandy loam surface layer. The underlying material is stratified layers of fine sand, loamy sand, and silt loam. Permeability is moderately rapid. Some areas are flooded in some years.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is needleandthread and bluebunch wheatgrass, 25 percent each; prairie sandreed, 15 percent; short grasses, 10 percent; and sideoats grama, native legumes, perennial forbs, silver sagebrush, and other shrubs, 5 percent each.

This range site in excellent condition produces approximately 1,800 pounds per acre of air-dry herbage in years

of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture. Approximately 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, prairie sandreed and bluebunch wheatgrass decrease. Needleandthread, western wheatgrass, threadleaf sedge, sand dropseed, plains reedgrass, plains muhly, prairie junegrass, silver sagebrush, forbs, and woody plants increase. If overgrazing continues, red threeawn, weedy forbs, broom snakeweed, and annuals invade the site.

Management practices are needed that maintain or improve the vegetative cover, mulch, and soil structure; that control erosion and pollution; and that produce the maximum amount of native forage.

*Silty range site (10- to 14-inch precipitation zone)*

This range site consists of deep and moderately deep, well drained soils on terraces, alluvial fans, and uplands. Slopes are 0 to 15 percent. The soils have a loam, gravelly loam, or silt loam surface layer. The underlying material is mostly silt loam to clay loam but some soils are underlain by shale or gravel. Permeability is moderately slow or moderate.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is bluebunch wheatgrass, 40 percent; needleandthread, 15 percent; western wheatgrass and short grasses, 10 percent each; green needlegrass, basin wildrye, perennial forbs, big and silver sagebrush, and other shrubs, 5 percent each.

This range site in excellent condition produces about 1,800 pounds of air-dry herbage per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture. About 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, bluebunch wheatgrass, green needlegrass, and basin wildrye decrease. Western wheatgrass, needleandthread, threadleaf sedge, blue grama, Sandberg bluegrass, prairie junegrass, big sagebrush, and forbs increase. If overgrazing continues, curlycup gumweed, broom snakeweed, annuals, and noxious weeds invade the site.

Management practices are needed to maintain or improve the vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Silty range site (15- to 19-inch precipitation zone)*

This range site consists of deep, well drained soils on hills, alluvial fans, and foot slopes. Slopes are 0 to 60 percent. The soils have a gravelly loam, cobbly loam, stony loam, or loam surface layer and underlying material. Some soils contain 45 to 70 percent coarse fragments.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is rough fescue, 40 percent; bluebunch wheatgrass, 15 percent; Idaho fescue, 10 percent; and Columbia needlegrass, needleandthread, basin wildrye, danthonias, lupine, other perennial forbs, and big sagebrush, 5 percent each.

This range site in excellent condition produces approximately 2,500 pounds of air-dry herbage per acre in years of favorable moisture and 1,500 pounds per acre in years of unfavorable moisture. Approximately 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, rough fescue, bluebunch wheatgrass, Columbia needlegrass, and basin wildrye decrease. Western wheatgrass, Idaho fescue, needleandthread, timber danthonia, lupine, and big sagebrush increase. If overgrazing continues, Kentucky bluegrass, curlycup gumweed, rabbitbrush, broom snakeweed, annual bromes, spotted knapweed, and other noxious weeds invade the site.

Management practices are needed to maintain or improve the vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Clayey range site (10- to 14-inch precipitation zone)*

This range site consists of deep or moderately deep, well drained soils on alluvial fans, foot slopes, and terraces. Slopes are 0 to 15 percent. The soils have a silty clay loam surface layer. Moderately deep soils are underlain by shale or sandstone at a depth of 20 to 40 inches. Permeability is slow or moderately slow.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is bluebunch wheatgrass, 30 percent; western wheatgrass and green needlegrass, 20 percent each; short grasses, 10 percent; and basin wildrye, native legumes, perennial forbs, and big sagebrush, 5 percent each.

This range site in excellent condition produces about 1,800 pounds of air-dry herbage per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture. About 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, green needlegrass and bluebunch wheatgrass decrease. Western wheatgrass, plains reedgrass, prairie junegrass, Sandberg bluegrass, big sagebrush, and perennial forbs increase. If overgrazing continues, curlycup gumweed, broom snakeweed, annual fescue, bromes, and biennial forbs invade the site.

Management practices are needed to maintain or improve the vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Clayey range site (15- to 19-inch precipitation zone)*

This range site consists of deep and moderately deep, well drained soils on alluvial fans, foot slopes, and

uplands. Slopes are 0 to 50 percent. The soils have a clay loam, stony clay loam, or silty clay loam surface layer. Some soils are underlain by shale or gravel at a depth of 20 to 40 inches. Permeability is very slow to moderate.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is rough fescue, 40 percent; bluebunch wheatgrass, 15 percent; Columbia needlegrass and Idaho fescue, 10 percent each; and western wheatgrass, basin wildrye, lupine, other perennial forbs, and big sagebrush, 5 percent each.

This range site in excellent condition produces approximately 2,500 pounds of air-dry herbage per acre in years of favorable moisture and 1,800 pounds per acre in years of unfavorable moisture. Approximately 90 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, rough fescue, Columbia needlegrass, bluebunch wheatgrass, and basin wildrye decrease. Western wheatgrass, Idaho fescue, plains reedgrass, big sagebrush, and various perennial forbs and woody plants increase. If overgrazing continues, Kentucky bluegrass, danthonias, curlycup gumweed, broom snakeweed, and various noxious weeds invade the site.

Management practices are needed to maintain or improve the vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Shallow Clay range site (10- to 14-inch precipitation zone)*

Yawdim clay loam is the only soil in this range site. This shallow, well drained soil is on hillsides, divides, and foot slopes in the uplands. Slopes are 4 to 60 percent. The soil is underlain by shale at a depth of less than 20 inches. Permeability is slow.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is bluebunch wheatgrass, 40 percent; western wheatgrass and green needlegrass, 20 percent each; short grasses, 10 percent; and perennial forbs and big sagebrush, 5 percent each.

This range site in excellent condition produces about 1,400 pounds of air-dry herbage per acre in years of favorable moisture and 700 pounds per acre in years of unfavorable moisture. About 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, bluebunch wheatgrass, western wheatgrass, green needlegrass, and perennial forbs decrease. Plains reedgrass, Sandberg bluegrass, big sagebrush, and other woody plants increase. If overgrazing continues, foxtail barley, needleleaf sedge, curlycup gumweed, broom snakeweed, and annual plants invade the site.

Management practices are needed to maintain or improve vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Shallow Clay range site (15- to 19-inch precipitation zone)*

Wayden clay loam is the only soil in this range site. This shallow, well drained soil is on hillsides, divides, and foot slopes in the uplands. Slopes are 15 to 50 percent. This soil has a clay loam surface layer. Shale is at a depth of less than 20 inches. Permeability is slow.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is rough fescue, 40 percent; bluebunch wheatgrass, 15 percent; Columbia needlegrass and Idaho fescue, 10 percent each; and western wheatgrass, basin wildrye, lupine, other perennial forbs, and big sagebrush, 5 percent each.

This range site in excellent condition produces approximately 1,800 pounds of air-dry herbage per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture. Approximately 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, rough fescue, bluebunch wheatgrass, basin wildrye, and Columbia needlegrass decrease. Idaho fescue, danthonias, prairie junegrass, Sandberg bluegrass, big sagebrush, forbs, and other woody plants increase. If overgrazing is prolonged, Kentucky bluegrass, Timothy, curlycup gumweed, and broom snakeweed invade to make up a substantial part of the plant cover. The total production of usable forage is greatly reduced by invading plants.

Proper grazing management, such as planned grazing systems, can be expected to maintain or increase forage production and arrest erosion on this site.

*Shallow to Gravel range site (10- to 14-inch precipitation zone)*

Beaverell gravelly loam and very gravelly loam are the soils in this range site. These deep, well drained soils are on terraces. Slopes are 0 to 8 percent. The surface layer is very gravelly loam or gravelly loam, and the underlying material is very gravelly sand at a depth of 10 to 20 inches. The profile contains 45 to 70 percent coarse fragments. Permeability is moderate to a depth of about 12 inches and very rapid below.

The approximate species composition, by percent of the total weight, of the climax (potential) plant community is bluebunch wheatgrass, 55 percent; needleandthread, 20 percent; threadleaf sedge, blue grama, perennial forbs, and shrubs, 5 percent each; prairie junegrass, 3 percent; and Sandberg bluegrass, 2 percent.

This range site in excellent condition produces approximately 1,200 pounds of air-dry herbage per acre in years of favorable moisture and 500 pounds per acre in years of unfavorable moisture. Approximately 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, bluebunch wheatgrass decreases. Blue grama, Sandberg bluegrass, prairie junegrass, plains muhly, sedges, some forbs, and conifers in-

crease. If overgrazing continues, red threeawn, curlycup gumweed, broom snakeweed, noxious weeds, and annual grasses invade the site.

Management practices are needed to maintain or improve the vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Shallow range site (10- to 14-inch precipitation zone)*

This range site consists of shallow, well drained soils on hills and divides in the uplands. Slopes are 4 to 30 percent. The soils have a loam or channery loam surface layer. Permeability is moderate or moderately rapid. Some soils contain 35 to 70 percent coarse fragments. A few rock outcrops occur in some places.

The approximate species composition, by percent of the total weight, of the climax (potential) plant community is bluebunch wheatgrass, 50 percent; needleandthread, 20 percent; western wheatgrass, 10 percent; and threadleaf sedge, blue grama, perennial forbs, and shrubs, 5 percent each.

This site in excellent condition produces approximately 1,200 pounds of air-dry herbage per acre in years of favorable moisture and 500 pounds per acre in years of unfavorable moisture. Approximately 95 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, bluebunch wheatgrass decreases. Western wheatgrass, needleandthread, prairie junegrass, Sandberg bluegrass, blue grama, and forbs increase. If overgrazing continues, red threeawn, needleleaf sedge, curlycup gumweed, brown snakeweed, annual bromes, and annual fescues invade the site.

Management practices are needed to maintain or improve the vegetative cover, mulch, and soil structure; to control erosion and pollution; and to produce the maximum amount of native forage.

*Shallow range site (15- to 19-inch precipitation zone)*

This range site consists of shallow, well drained soils on hills and divides in the uplands. Slopes are 2 to 70 percent. The soils have a channery loam to clay loam surface layer. The underlying bedrock is sandstone and shale. Permeability is moderately slow or moderate. Some soils contain 45 to 70 percent coarse fragments and rock outcrops occur in some places.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is rough fescue and bluebunch wheatgrass, 25 percent each; Idaho fescue, 15 percent; and Columbia needlegrass, needleandthread, danthonias, prairie junegrass, lupine, other perennial forbs, and shrubs, 5 percent each.

This range site in excellent condition produces approximately 1,800 pounds of air-dry herbage per acre in years of favorable moisture and 1,000 pounds per acre in years of unfavorable moisture. Approximately 90 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, bluebunch wheatgrass and rough fescue decrease; Idaho fescue, needleandthread, prairie junegrass, Sandberg bluegrass, forbs, and big sagebrush increase. If overgrazing continues, onespike danthonia, sandwort, pussytoes, rabbitbrush, broom snakeweed, and annuals invade the site.

Proper grazing management, such as planned grazing systems, can be expected to maintain or increase forage production and to arrest erosion on this site.

*Dense Clay range site (10- to 14-inch precipitation zone)*

Absher silty clay loam, 0 to 6 percent slopes, is the only soil in this range site. This is a deep, well drained soil on uplands and alluvial fans. This soil has a silty clay loam surface layer, and in places a 1/2- to 3/4-inch crust is on the surface. Permeability is very slow.

The approximate species composition, by percentage of the total weight, of the climax (potential) plant community is western wheatgrass, 35 percent; green needlegrass, 30 percent; and inland saltgrass, prairie junegrass, Sandberg bluegrass, greasewood, Nuttall saltbush, big sagebrush, and perennial forbs, 5 percent each.

This range site in excellent condition produces approximately 1,200 pounds of air-dry herbage per acre in years of favorable moisture and 500 pounds per acre in years of unfavorable moisture. Approximately 90 percent of this production is from plants that furnish forage for cattle, sheep, and big game.

Under continued heavy grazing, western wheatgrass, green needlegrass, and Nuttall saltbush decrease. Sandberg bluegrass, inland saltgrass, greasewood, rabbitbrush, and other woody plants increase. Curlycup gumweed, foxtail barley, broom snakeweed, and annuals invade to make up a substantial part of the plant cover. The total production of usable forage is greatly reduced by these invaders.

Proper grazing management, such as planned grazing systems, can be expected to maintain or increase forage production and reduce the risk of erosion on the site.

## Wildlife

The soils, topography, climate, wide variety of native and other kinds of vegetation, and other features favor wildlife habitat development in the Stillwater County Area. The principal kinds of native game are white-tailed deer, mule deer, elk, pronghorn antelope, ring-necked pheasant, gray partridge, and sharp-tailed, ruffed, and blue grouse. Furbearers include raccoon, fox, skunk, beaver, and mink. Predator species include coyote, bobcat, black bear, and mountain lion.

Most ponds and lakes are stocked with trout, and the Yellowstone and Stillwater Rivers and Rosebud Creek provide good to excellent fishing. Ducks and geese use the lakes, impoundments, and streams during their migration.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind

and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 3, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

*Grain and seed crops* are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are wheat, oats, and barley.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are ryegrass, panicgrass, annual and shrub lespedeza, and clovers.

*Wild herbaceous plants* are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, grama, perennial forbs, and legumes.

*Hardwood trees* and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of hardwood plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are oak, beech, cherry, dogwood, maple, viburnum, grape, greenbrier, and silverberry.

*Coniferous plants* are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and ornamental trees and shrubs.

*Shrubs* are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are bitterbrush, rabbitbrush, big sagebrush, and greasewood.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, spikerush, tearthumb, and eneilema and rushes, sedges, and burseed.

*Shallow water areas* are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

*Openland habitat* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous

plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

*Woodland habitat* consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, blue and ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

*Wetland habitat* consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

*Rangeland habitat* consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include antelope, white-tailed deer, desert mule deer, sage grouse, meadowlark, and lark bunting.

## Recreation

The soils of the survey area are rated in table 4 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 4 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 6, and interpretations for dwellings without basements and for local roads and streets, given in table 5.

*Camp areas* require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

*Playgrounds* require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

*Paths and trails* for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

## Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. If pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

*Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.*

The information is presented mainly in tables. Table 5 shows, for each kind of soil, the degree and kind of limitations for building site development; table 6, for sanitary facilities; and table 8, for water management. Table 7 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

### Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 5. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

*Shallow excavations* are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

*Dwellings* and *small commercial buildings* referred to in table 5 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

*Local roads and streets* referred to in table 5 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding,

slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

### Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 6 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good, fair*, and *poor*, which mean about the same as *slight, moderate*, and *severe*.

*Septic tank absorption fields* are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

*Sewage lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard if the seasonal high water table is above the level of the lagoon floor. If the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

*Sanitary landfill* is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 6 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

*Daily cover for landfill* should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils sur-

rounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

### Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 7 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction material. Each soil is evaluated to the depth observed, generally about 6 feet.

*Roadfill* is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 9 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low frost action potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

*Sand* and *gravel* are used in great quantities in many kinds of construction. The ratings in table 7 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 9.

*Topsoil* is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

### Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 8 the soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

*Embankments, dikes, and levees* require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

*Drainage* of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to

the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

*Irrigation* is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

*Grassed waterways* are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

# Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

## Engineering properties

Table 9 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 9 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Description of the soils."

*Texture* is described in table 9 in the standard terms used by the U.S. Department of Agriculture (*6*). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification is given in table 9. Also in table 9 the percentage, by weight, of rock fragments more than 3 inches in diameter

is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

*Liquid limit* and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and in plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

## Physical and chemical properties

Table 10 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, of each soil. The estimates are based on field observations and on test data for these and similar soils.

*Permeability* is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

*Available water capacity* is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

*Soil reaction* is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

*Salinity* is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 10. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

*Shrink-swell potential* depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

*Risk of corrosion* pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

*Erosion factors* are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

*Wind erodibility groups* are made up of soils that have similar porperties that affect their resistance to soil blow-

ing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

## Soil and water features

Table 11 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

*Hydrologic soil groups* are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

*Flooding* is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*High water table* is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 11 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such in-

formation is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

*Depth to bedrock* is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

*Potential frost action* refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

## Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*7*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 12, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, nonacid, mesic, Typic Haplaquents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

## Formation of the soils

Soil are formed by forces of the environment acting on materials deposited or accumulated by geologic processes. The characteristics of a soil at any particular place are determined by (1) the physical and mineralogical composition of the parent material; (2) the relief, or lay of the land, which influences drainage, moisture, aeration, and exposure to the sun and elements; (3) plants and animals living in and on the soil; (4) the climate in which the soil material has accumulated and existed since accumulation; and (5) the length of time that the climatic and the biological forces have acted on the soil material.

## Parent material

All material from which soil developed was derived from weathered bedrock that was either local or was transported from other areas. The material may have been weathered from the rock directly beneath the soil, or it may have been moved by gravity, wind, or water to its present location. Wayden soils are examples of soils that formed in place. Havre and Lohler soils formed in material transported from other places.

Parent material directly influences the texture of a soil. The soils of the survey area range from fine sandy loam to clay because they formed in sandstone and clayey shale and in alluvium. Soils that form in mixed alluvium that contains many kinds of material generally are loamy. For example, in the Stillwater County Area, Havre loams formed in alluvium. Soils derived mainly from sandstone, such as those in the Assinniboine series, generally are sandy. Wayden soils were derived from shale and are clayey because clay is a basic ingredient of shale. Absher soils developed from alkaline shale and from alluvium that was derived from alkaline shale.

## Relief

The Stillwater County Area is on the northwestward-plunging anticline of the Pryor Mountains, a fold that is parallel with and near the fold of the Big Horn and Beartooth Mountains. Exposures of late Paleozoic and Mesozoic Formations form a semicircle around the northwest end of the Pryor and Beartooth Mountains. The Area is a dissected pediment surface that has remnants of the former upland surface along the divides. It has a dendritic type of drainage pattern. In places, such as the Yellowstone and Stillwater Valleys, relief is low to moderate and is characterized by broad alluvial valleys and smooth stream terraces.

The sedimentary deposits that underlie the survey area resist erosion to varying degrees.

## Plants and animals

Plants and animals are active agents in soil formation. Fungi and algae, among the earliest inhabitants of rock material, contribute to the decomposition of rock. As decomposition progresses, plants are established, and they contribute acids and litter. The litter from a coniferous forest generally is acid, and that from grass is less acid. Soils that formed under grass, such as the Beenom and Tanna soils, do not leach readily.

Plants contribute most of the organic matter that is in the soil. When leaves, twigs, stems, and roots decompose, they are incorporated into the soil. Organic matter is the main cause of dark colors in the surface layer of a soil.

Animals also contribute to the organic-matter content of a soil, and they also mix and move soil material. Earthworms and burrowing animals especially help to incorporate decomposing organic material into the soil.

The plants and animals on or in the soils of the Stillwater County Area are highly diverse. Plants range from short bunch grasses in the driest parts of the area to Douglas-fir in the Beartooth Mountains.

## Climate

Climate also is an active force in soil formation. In the Stillwater County Area, precipitation ranges from about 10 to 24 inches. Attewan soils are dominant in the driest and warmest parts of the area; Garlet and Sebud soils are dominant in the coolest and most humid parts. For more information on temperature and precipitation, refer to the section "General nature of the area."

## Time

Because it is difficult to tell precisely how many years soil material has weathered since it was deposited, soils are defined in relative terms such as "young" and "mature." Properties used to establish a "young" soil are thickness of the A1 horizon, content of organic matter, depth of leaching of soluble salts, and the form and distribution of calcium carbonates. The age of a "mature" soil is determined partly by the accumulation and orientation of clay in the B horizon, by the kind and grade of soil structure, and by the degree of weathering of primary and secondary minerals.

Havre loam, on the first bottom of the flood plain of an active stream, contains little organic matter in the surface layer, has no clay accumulation, and has little translocation of carbonates. It is considered a young soil. A similar soil, in the Attewan series, on the second terrace has more organic matter and segregation of lime; it is considered to be an older soil than Havre loam. Grail soils, farther away from the apparent source of material, have enough organic matter to give a dark color to the surface layer, have distinct clay accumulation, and have had most of the carbonates removed from the solum. Grail soils are considered to be older than Havre and Attewan soils.

# General nature of the area

In this section, physiography and drainage, ground water sources, climate, natural resources, settlement and farming, and industry, markets, and transportation of the survey area are discussed. Statistics for population and agriculture are from reports by the U. S. Bureau of the Census and the U. S. Department of Agriculture.

## Physiography and drainage

The Stillwater County Area includes exposures of late Paleozoic and Mesozoic Formations, which form a semicircle around the northern ends of the Pryor and Beartooth Mountains. The formations outcrop in a series of steep mountain-facing scarps and long gentle slopes that extend away from the sandstone cliffs down to the lowland valleys, which are eroded into the shale beds.

Elevation ranges from 3,200 feet above sea level along the Yellowstone River near Park City to 12,610 feet at Silver Run Peak in the Beartooth Mountains. Local relief is generally less than 600 feet, and changes are gradual, except in the Beartooth Mountains.

The topography of the area can be divided into the Beartooth Mountains, the plains, the lake basin, the zone of faulting, the terraces, and the Yellowstone and Stillwater River Valleys.

The Custer National Forest includes most of the Beartooth Mountains. The climate is semiarid. Runoff from heavy rains causes slight to moderate erosion on the nearly horizontal beds of sandstone and shale. Streams flow intermittently in the northern part of the area and carry large amounts of water when rains are heavy. Because slopes are steep, the streams also carry large amounts of suspended sediment.

The largest part of the survey area consists of rolling dissected plains. There are outcrops of sandstone and shale. Because the shale weathers faster than the sandstone, the sandstone forms very steep cliffs at various levels. The shale landscape where there is less plant cover and, consequently, greater runoff and erosion is more rolling and dissected than in other areas.

The lake basins in the northeastern part of the area are undrained or poorly drained depressions or temporary lakes that vary in size. The largest lake basin is between the towns of Rapelje and Molt. It is 900 feet above the Yellowstone River Valley.

The general structure of the anticline is interrupted in many places by faulting and warping, which in some places produce dips of 20 degrees. Many faults occur in the area. Faults conspicuously interrupt the escarpments, and the amount of horizontal or vertical displacement can be readily determined in most places. The fault plane is itself visible or its portion is marked by brecciation of the sandstone and some crumpling of the adjacent shale beds. None of the faults are of the thrust variety. There are three fault directions in the survey area: those that strike west, those that strike north 45 degrees west, and those that strike north. There is no evidence that these fault systems originated at different times.

The glacial outwash terraces along the front of the Beartooth Mountains formed in gravelly alluvium. The lowest terraces are those along the rivers, and the highest outwash terraces are those to the south near Absarokee, Montana.

Gravelly alluvium covers large areas along the Yellowstone and Stillwater Rivers. The Yellowstone River Valley ranges in width from a few hundred yards to about 4 miles and lies 100 to 500 feet below the surrounding upland plains. The valleys are wider where they are cut in shale than where they are cut in sandstone because the sandstone is more resistant to stream erosion.

The Stillwater County Area is drained by the Yellowstone River, except for the northeastern and northwestern parts which are drained by the Musselshell River. The Yellowstone River flows southeast through a fairly steep-walled valley. It ranges in width from a few hundred feet to more than one-half mile, and it carries a large volume of water. The only tributaries of the river that carry water the year round are the Stillwater River and the Rosebud River, which flow from the southern part of the area in a northeast direction to the Yellowstone River. White Beaver Creek, Berry Creek, Keyser Creek, Brown Creek, Hensley Creek, and Valley Creek flow from the northern part in a southeast direction to the Yellowstone River.

## Ground water sources

Stillwater County is underlain by shale and sandstone about 5,000 feet thick. The shale is generally dry and yields water of poor quality, but in some areas it yields water that can be used by livestock.

The sandstone yields water adequate in quantity and quality for both domestic and livestock use. The sandstone does not yield enough water for large-scale irrigation; furthermore, the water is too highly mineralized for use on the soils. The water from areas where sandstone is covered by thick marine shale is generally of poor quality.

The rocks that crop out in the county date from the Quaternary to the Jurassic Periods. Older, deeper rocks of the Swift, Tensleep, Amsden, and Madison Limestone Formations contain sufficient water under pressure for artesian wells.

## Climate of the area

The climate of the Stillwater County Area is continental, with several important modifications imposed by the mountain-valley-plain physiography. In both precipitation and temperature patterns, elevation and direction of slope play a primary role. Precipitation variations are particularly noticeable across the mountainous part of the area. Annual averages range from a maximum of about 70 inches near the headwaters of East Rosebud and Stillwater Rivers to a minimum of about 14 inches along the Yellowstone River and 10 inches at Rapelje, 25 miles north of Columbus. The high mountains south of the area are the cause of the prevailing west to southwest flow of air.

During the cold season, nearly all precipitation falls as snow. At the lower elevations, snow seldom remains on the ground very long. But in the mountains and foothills, snow begins accumulating in November in most years and reaches its greatest depth and water content in April or early in May. Snowfall in the mountains is estimated to reach a total of several hundred inches. Snowfall is less than 30 inches a year in the lower parts of the area in the north. Snow depth at the higher elevations averages about 150 inches on about the first of May.

The melting of mountain snowpacks during spring and early in summer contributes to stable, and usually plentiful, runoff in most years. Occasionally, heavy rains late in May or in June coincide with periods of peak runoff from

snowmelt, and in about 1 year in 10 this combination causes flooding of some streams.

Summer precipitation almost always occurs as showers.

The range in temperature across the survey area is fairly wide, as is shown in table 13. In the mountain country south and southwest of Absarokee, the average temperature is less than 40 degrees Fahrenheit, and along the northeastern part of the area east of Columbus and north of the Yellowstone River, the average annual temperature is 45 degrees. In summer the temperature is fairly uniform and seldom reaches oppressive levels.

In Columbus, in a 30-year period, in only 2 months out of the year, on the average, did the temperature rise to 90 degrees or higher. At higher elevations the average was much less. The frost-free period (32 degrees F) averages 90 to 110 days at elevations of more than 4,000 feet, and 110 to 120 days along the Yellowstone River east of Columbus. The last killing frost occurs, on the average, in mid to late June.

Much of the area is favorably situated to receive the "Chinook" wind of the northern Rockies. When this wind develops following a winter cold spell, warming can be rapid—as much as 40 to 50 degrees in less than a day, and this tends to shorten winter cold spells. An invasion of really cold arctic air seldom lasts more than 3 days. Severe storms are not common; however, hailstorms, high winds, heavy snow, freezing rain and sleet, and small tornadoes have occurred at intervals of several years somewhere in the county. Damaging hailstorms occur in about 1 year in 10 at the lower elevations.

## Natural resources

There are no commercial mines operating in the Stillwater County Area, though there is subbituminous coal in some small areas. The coal that is mined is used locally.

There are gas fields at various locations within the survey area, but the principal gas field lies to the north of the area. These gas fields supply the county and some areas outside the county.

Timberland is generally a part of ranches and is grazed. Cottonwood trees grow along the rivers and large streams. Ponderosa pine trees grow on the dissected uplands. These trees are used locally for fence posts and lumber.

Chrome was mined in the southwestern part of the county during World War II. This operation has ceased, and only exploration is being done at the present time.

Sand and gravel underlying river terraces and high glacial outwash terraces are used locally in road and building construction. Small amounts of rock, primarily sandstone and shale, are used in road surfacing.

## Settlement and farming

Stillwater County was formed from parts of Yellowstone, Carbon, and Sweet Grass Counties on March 24, 1913. The county was named for the Stillwater River. The county seat is Columbus.

Horace Countryman settled in Stillwater County and opened a trading post at the mouth of Countryman Creek. He built the first house between Fort Buford, 500 miles east, and Bozeman, 100 miles west on the Yellowstone River and Gallatin River.

In 1883 the Northern Pacific built a railroad line along the Yellowstone River Valley. Agriculture in the area started with the cattle industry in 1866 and has continued as one of the main industries. The major income in the area comes from ranching. Cattle, sheep, and hogs are the main sources of income. Wheat, oats, barley, and hay are the main dryland crops. Sugar beets and alfalfa hay are the main irrigated crops; they are grown in the river valleys.

Dude ranches in the area provide recreation for people from the large eastern cities. Many summer homes and cabins are located along the Stillwater and Rosebud Rivers.

In 1969, there were 453 farms in Stillwater County. The 1970 population of Stillwater County was 2,606. Columbus had 1,281 people, Fishtail had 50, Molt had 50, Nye had 225, Park City had 350, Rapelje had 115, Reedpoint had 130, and Absarokee had 600.

## Industry, markets, and transportation

Numerous cattle and hog feedlots produce beef and pork for both eastern and western markets.

Natural gas pipelines supply heating fuel to the larger towns in the survey area. The natural gas originates in small fields in the northern part of the area. An industry that constructs structural beams for use in large buildings is located in Columbus.

Wheat is marketed at elevators in Rapelje, Wheat Basin, Molt, and Columbus. Transportation is by railroad and by truck over Interstate Highway 90. The railroad system traverses the survey area from east to west along the Yellowstone River Valley. Interstate 90 also traverses the area from east to west.

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# Glossary

**Alkali (sodic) soil.** A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

| | *Inches* |
|---|---|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Moderate | 6 to 9 |
| High | More than 9 |

**Channery soil.** A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

**Climax vegetation.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

**Decreasers.** The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

**Deferred grazing.** A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class** (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained.*—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

*Somewhat excessively drained.*—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

*Well drained.*—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

*Moderately well drained.*—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

*Somewhat poorly drained.*—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

*Poorly drained.*—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

*Very poorly drained.*—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

**Erosion.** The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

**Fallow.** Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

**Flooding.** The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is

expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

**Gully.** A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

*O horizon.*—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

*A horizon.*—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

*A2 horizon.*—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

*R layer.*—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

**Increasers.** Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are—

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Corrugation.*—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

*Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

*Wild flooding.*—Water, released at high points, is allowed to flow onto an area without controlled distribution.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

**Munsell notation.** A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Permeability.** The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

**pH value.** (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

**Range condition.** The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent*, *good*, *fair*, and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

| | *pH* |
|---|---|
| Extremely acid | Below 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Medium acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Mildly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Saline soil.** A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Substratum.** The part of the soil below the solum.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt*, *silt loam*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Tilth, soil.** The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

**Water table.** The upper limit of the soil or underlying rock material that is wholly saturated with water.

*Water table, apparent.* A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

*Water table, artesian.* A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

# Tables

TABLE 1.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| 1 | Absarokee clay loam, 2 to 8 percent slopes | 14,950 | 1.6 |
| 2 | Absarokee clay loam, 8 to 15 percent slopes | 9,110 | 0.9 |
| 3 | Absarokee-Sinnigam clay loams, 2 to 8 percent slopes | 22,710 | 2.4 |
| 4 | Absarokee-Sinnigam clay loams, 8 to 15 percent slopes | 25,010 | 2.6 |
| 5* | Absarokee-Sinnigam complex, 15 to 50 percent slopes | 27,780 | 2.9 |
| 6 | Absarokee-Amherst-Castner complex, 4 to 8 percent slopes | 6,440 | 0.7 |
| 7 | Absher silty clay loam, 0 to 6 percent slopes | 16,000 | 1.7 |
| 8 | Amherst-Absarokee-Castner complex, 8 to 15 percent slopes | 4,870 | 0.5 |
| 9 | Assinniboine fine sandy loam, 2 to 15 percent slopes | 5,020 | 0.5 |
| 10 | Assinniboine-Rentsac complex, 6 to 12 percent slopes | 1,640 | 0.2 |
| 11 | Attewan loam, 0 to 4 percent slopes | 3,710 | 0.4 |
| 12 | Attewan loam, seeped, 0 to 4 percent slopes | 2,650 | 0.3 |
| 13 | Attewan-Beaverell gravelly loams, 0 to 4 percent slopes | 1,410 | 0.1 |
| 14 | Beaverell very gravelly loam, 0 to 8 percent slopes | 1,500 | 0.2 |
| 15* | Birney-Yawdim-Rock outcrop association, steep | 29,720 | 3.1 |
| 16 | Bonfri-Lambeth complex, 2 to 8 percent slopes | 21,620 | 2.3 |
| 17 | Bonfri-Lambeth complex, 8 to 15 percent slopes | 3,840 | 0.4 |
| 18* | Garlet-Sebud association, very steep | 5,400 | 0.6 |
| 19 | Glendive fine sandy loam, 0 to 4 percent slopes | 1,830 | 0.2 |
| 20 | Glendive fine sandy loam, occasionally flooded | 740 | 0.1 |
| 21 | Grail clay loam, 0 to 4 percent slopes | 12,700 | 1.3 |
| 22 | Grail clay loam, 4 to 8 percent slopes | 7,740 | 0.8 |
| 23 | Harlem clay loam, 0 to 2 percent slopes | 820 | 0.1 |
| 24 | Harlem clay loam, occasionally flooded | 870 | 0.1 |
| 25 | Havre loam, 0 to 2 percent slopes | 3,620 | 0.4 |
| 26 | Havre loam, 2 to 4 percent slopes | 2,820 | 0.3 |
| 27 | Havre loam, occasionally flooded | 1,170 | 0.1 |
| 28* | Hilger-Castner-Rock outcrop complex, 25 to 60 percent slopes | 22,870 | 2.4 |
| 29 | Kobar clay loam, 0 to 4 percent slopes | 5,390 | 0.6 |
| 30 | Kobar clay loam, 4 to 8 percent slopes | 6,310 | 0.7 |
| 31 | Lambeth silt loam, 2 to 15 percent slopes | 3,260 | 0.3 |
| 32 | Lambeth-Rentsac complex, 4 to 15 percent slopes | 3,450 | 0.4 |
| 33 | Lambeth-Yawdim complex, 4 to 15 percent slopes | 36,790 | 3.8 |
| 34* | Lardell clay loam, 0 to 2 percent slopes | 20,350 | 2.1 |
| 35 | Lohler clay loam, 0 to 2 percent slopes | 1,420 | 0.1 |
| 36 | Lohler clay loam, 2 to 4 percent slopes | 1,990 | 0.2 |
| 37 | Lolo complex, 0 to 4 percent slopes | 5,440 | 0.6 |
| 38* | Lolo and Nesda soils, flooded | 4,910 | 0.5 |
| 39 | Lonna silt loam, 2 to 8 percent slopes | 9,120 | 0.9 |
| 40 | Lonna silt loam, 8 to 15 percent slopes | 6,910 | 0.7 |
| 41* | McKenzie clay, saline | 18,250 | 1.9 |
| 42 | Rentsac loam, 15 to 30 percent slopes | 6,570 | 0.7 |
| 43* | Rock outcrop-Castner association, steep | 1,000 | 0.1 |
| 44* | Rock outcrop-Garlet association, very steep | 1,130 | 0.1 |
| 45* | Rock outcrop-Yawdim association, steep | 4,680 | 0.5 |
| 46* | Sebud stony loam, 4 to 25 percent slopes | 4,500 | 0.5 |
| 47* | Sebud stony loam, 25 to 50 percent slopes | 6,400 | 0.7 |
| 48* | Sebud-Cheadle association, very steep | 3,150 | 0.3 |
| 49 | Shane clay loam, 4 to 8 percent slopes | 3,290 | 0.3 |
| 50 | Shane clay loam, 8 to 15 percent slopes | 1,100 | 0.1 |
| 51 | Shane-Cabba clay loams, 4 to 10 percent slopes | 900 | 0.1 |
| 52 | Shawa silty clay loam, 0 to 8 percent slopes | 3,920 | 0.4 |
| 53 | Tanna clay loam, 2 to 8 percent slopes | 50,570 | 5.3 |
| 54 | Tanna clay loam, 8 to 15 percent slopes | 5,760 | 0.6 |
| 55 | Tanna-Beenom complex, 4 to 8 percent slopes | 38,140 | 4.0 |
| 56 | Tanna-Rentsac complex, 4 to 15 percent slopes | 147,270 | 15.4 |
| 57* | Torrifluvents-Camborthids association, gently sloping | 12,500 | 1.3 |
| 58 | Turner clay loam, 2 to 4 percent slopes | 9,580 | 1.0 |
| 59 | Turner clay loam, 4 to 8 percent slopes | 4,080 | 0.4 |
| 60 | Turner stony clay loam, 4 to 15 percent slopes | 1,960 | 0.2 |
| 61* | Ustifluvents-Fluvaquents association, flooded | 3,330 | 0.3 |
| 62* | Ustifluvents-Ustochrepts association, gently sloping | 1,900 | 0.2 |
| 63* | Wayden-Castner association, steep | 44,750 | 4.7 |
| 64* | Winkler-Hilger-Rock outcrop association, steep | 47,120 | 4.9 |
| 65 | Work loam, 4 to 8 percent slopes | 10,600 | 1.1 |
| 66 | Work loam, 8 to 15 percent slopes | 2,990 | 0.3 |
| 67 | Yamac loam, 0 to 2 percent slopes | 2,930 | 0.3 |
| 68 | Yamac loam, 2 to 4 percent slopes | 6,930 | 0.7 |
| 69 | Yamac loam, 4 to 8 percent slopes | 10,710 | 1.1 |
| 70 | Yamac loam, 8 to 15 percent slopes | 1,800 | 0.2 |
| 71* | Yawdim-Lambeth-Rock outcrop association, steep | 127,050 | 13.3 |
| | Water | 8,680 | 0.9 |
| | Total | 957,440 | 100.0 |

*The soil is broadly defined.

TABLE 2.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. The estimates were made in 1974. Absence of data indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

| Soil name and map symbol | Corn silage | | Wheat, winter | | Barley | | Oats | | Sugar beets | | Alfalfa hay | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | I | N | I | N | I | N | I | N | I | N | I |
| | Ton | Ton | Bu | Bu | Bu | Bu | Bu | Bu | Ton | Ton | Ton | Ton |
| Absarokee: | | | | | | | | | | | | |
| 1 | --- | --- | 36 | --- | 40 | --- | 50 | --- | --- | --- | 2.0 | --- |
| 2 | --- | --- | 30 | --- | 35 | --- | 40 | --- | --- | --- | 1.5 | --- |
| [1]3 | --- | --- | 30 | --- | 35 | --- | --- | --- | --- | --- | 1.5 | --- |
| [1]4 | --- | --- | 25 | --- | 30 | --- | --- | --- | --- | --- | --- | --- |
| [1]6 | --- | --- | 25 | --- | 25 | --- | 40 | --- | --- | --- | 1.5 | --- |
| Assinniboine: | | | | | | | | | | | | |
| 9 | --- | --- | 26 | --- | 35 | --- | --- | --- | --- | --- | 1.5 | --- |
| Attewan: | | | | | | | | | | | | |
| 11 | --- | 25 | 30 | --- | 40 | 80 | --- | 100 | --- | 22 | 1.3 | 4.0 |
| [1]13 | --- | --- | --- | 20 | --- | 45 | --- | --- | --- | --- | --- | 2.0 |
| Bonfri: | | | | | | | | | | | | |
| [1]16 | --- | --- | 26 | --- | 29 | --- | 41 | --- | --- | --- | --- | --- |
| [1]17 | --- | --- | 22 | --- | 24 | --- | 35 | --- | --- | --- | --- | --- |
| Glendive: | | | | | | | | | | | | |
| 19 | --- | 25 | 30 | 50 | 35 | 60 | --- | 85 | --- | 22 | 1.5 | 5.0 |
| 20 | --- | 25 | 30 | 50 | 40 | 80 | --- | 90 | --- | 22 | 1.5 | 4.0 |
| Grail: | | | | | | | | | | | | |
| 21 | --- | --- | 30 | 50 | 58 | 75 | 68 | 80 | --- | --- | 2.0 | 5.0 |
| 22 | --- | --- | 25 | 40 | 44 | 70 | 52 | 75 | --- | --- | 1.8 | 4.5 |
| Harlem: | | | | | | | | | | | | |
| 23 | --- | 25 | 30 | 55 | 40 | 70 | 45 | 80 | --- | --- | 1.5 | 6.0 |
| 24 | --- | 25 | 30 | 55 | 40 | 65 | 50 | 80 | --- | --- | 1.5 | 6.0 |
| Havre: | | | | | | | | | | | | |
| 25, 27 | --- | 25 | 30 | 55 | 40 | 80 | 50 | 90 | --- | 22 | 2.0 | 7.0 |
| 26 | --- | 25 | 30 | 55 | 35 | 80 | 50 | 90 | --- | 22 | 1.5 | 7.0 |
| Kobar: | | | | | | | | | | | | |
| 29 | --- | 25 | 33 | 40 | 40 | 65 | --- | --- | --- | 22 | 1.0 | 5.0 |
| 30 | --- | 20 | 30 | 35 | 35 | 60 | --- | --- | --- | 20 | 1.0 | 4.8 |
| Lambeth: | | | | | | | | | | | | |
| 31 | --- | --- | 15 | --- | 20 | --- | 25 | --- | --- | --- | --- | --- |
| [1]32 | --- | --- | 15 | --- | 20 | --- | 25 | --- | --- | --- | --- | --- |
| Lohler: | | | | | | | | | | | | |
| 35 | --- | --- | 30 | 40 | 40 | 80 | 50 | 100 | --- | --- | 2.0 | 5.0 |
| 36 | --- | --- | 30 | 40 | 40 | 77 | 50 | 100 | --- | --- | 1.9 | 4.8 |

See footnote at end of table.

TABLE 2.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Soil name and map symbol | Corn silage | | Wheat, winter | | Barley | | Oats | | Sugar beets | | Alfalfa hay | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | I | N | I | N | I | N | I | N | I | N | I |
| | Ton | Ton | Bu | Bu | Bu | Bu | Bu | Bu | Ton | Ton | Ton | Ton |
| Lolo: | | | | | | | | | | | | |
| [1]37 | --- | --- | --- | --- | --- | | | | --- | --- | 2.3 | 5.3 |
| Lonna: | | | | | | | | | | | | |
| 39 | --- | --- | 28 | --- | 30 | --- | 45 | --- | --- | --- | 1.2 | --- |
| 40 | --- | --- | 25 | --- | 30 | --- | 40 | --- | --- | --- | 1.2 | --- |
| Shane: | | | | | | | | | | | | |
| 49 | --- | --- | 36 | --- | 40 | --- | --- | --- | --- | --- | 2.0 | --- |
| 50 | --- | --- | 25 | --- | 35 | --- | --- | --- | --- | --- | 2.0 | --- |
| [1]51 | --- | --- | 30 | --- | 40 | --- | --- | --- | --- | --- | 1.8 | --- |
| Shawa: | | | | | | | | | | | | |
| 52 | --- | --- | --- | 35 | 30 | 60 | 50 | 80 | --- | --- | 2.0 | 3.0 |
| Tanna: | | | | | | | | | | | | |
| 53 | --- | --- | 33 | --- | 40 | --- | --- | --- | --- | --- | 2.0 | --- |
| 54 | --- | --- | 25 | --- | 30 | --- | --- | --- | --- | --- | 1.5 | --- |
| [1]55 | --- | --- | 30 | --- | 37 | --- | --- | --- | --- | --- | 2.0 | --- |
| [1]56 | --- | --- | 20 | --- | 30 | --- | --- | --- | --- | --- | 1.0 | --- |
| Turner: | | | | | | | | | | | | |
| 58, 59 | 4.0 | 24 | 26 | --- | 32 | 75 | 36 | 85 | --- | 20 | 1.8 | 4.0 |
| Work: | | | | | | | | | | | | |
| 65 | --- | --- | 42 | --- | 42 | 65 | --- | --- | --- | --- | 1.9 | 4.0 |
| 66 | --- | --- | 38 | --- | 38 | --- | --- | --- | --- | --- | 1.6 | --- |
| Yamac: | | | | | | | | | | | | |
| 67 | --- | --- | 35 | --- | 40 | 65 | --- | --- | --- | --- | 1.5 | 5.0 |
| 68, 69 | --- | --- | 32 | --- | 40 | 62 | --- | --- | --- | --- | 1.5 | 4.8 |
| 70 | --- | --- | 29 | --- | 38 | --- | --- | --- | --- | --- | 1.0 | --- |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 3.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Potential for habitat elements | | | | | | | | Potential as habitat for-- | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife | Rangeland wildlife |
| Absarokee: | | | | | | | | | | | | |
| 1, 2 | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| [1]3: | | | | | | | | | | | | |
| Absarokee part | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Sinnigam part | Fair | Good | Good | --- | --- | Good | Very poor. | Very poor. | Good | --- | Very poor. | Good. |
| [1]4: | | | | | | | | | | | | |
| Absarokee part | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Sinnigam part | Fair | Good | Good | --- | --- | Good | Very poor. | Very poor. | Good | --- | Very poor. | Good. |
| [1]5*: | | | | | | | | | | | | |
| Absarokee part | Poor | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Sinnigam part | Poor | Fair | Good | --- | --- | Good | Very poor. | Very poor. | Fair | --- | Very poor. | Good. |
| [1]6: | | | | | | | | | | | | |
| Absarokee part | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Amherst part | Fair | Fair | Poor | --- | --- | Poor | Very poor. | Very poor. | Fair | --- | Very poor. | Poor. |
| Castner part | Poor | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Absher: | | | | | | | | | | | | |
| 7 | Poor | Poor | Very poor. | --- | Very poor. | Very poor. | Poor | Very poor. | Poor | Very poor. | Very poor. | Very poor. |
| Amherst: | | | | | | | | | | | | |
| [1]8: | | | | | | | | | | | | |
| Amherst part | Fair | Fair | Poor | --- | --- | Poor | Very poor. | Very poor. | Fair | --- | Very poor. | Poor. |
| Absarokee part | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Castner part | Poor | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Assinniboine: | | | | | | | | | | | | |
| 9 | Fair | Good | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| [1]10: | | | | | | | | | | | | |
| Assinniboine part | Fair | Good | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Rentsac part | Poor | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Attewan: | | | | | | | | | | | | |
| 11 | Fair | Fair | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |

See footnote at end of table.

TABLE 3.--WILDLIFE HABITAT POTENTIALS--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | | Potential as habitat for-- | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife | Rangeland wildlife |
| Attewan: | | | | | | | | | | | | |
| 12 | Good | Good | Good | --- | --- | Good | Good | Fair | Good | --- | Fair | Good. |
| [1]13: | | | | | | | | | | | | |
| Attewan part | Fair | Fair | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Beaverell part | Poor | Poor | Fair | --- | --- | Fair | Poor | Very poor. | Poor | --- | Very poor. | Fair. |
| Beaverell: | | | | | | | | | | | | |
| 14 | Poor | Poor | Fair | --- | --- | Fair | Poor | Very poor. | Poor | --- | Very poor. | Fair. |
| Birney: | | | | | | | | | | | | |
| [1]15*: | | | | | | | | | | | | |
| Birney part | Poor | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Yawdim part | Very poor. | Very poor. | Poor | --- | --- | Poor | Very poor. | Very poor. | Very poor. | --- | Very poor. | Poor. |
| Rock outcrop part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |
| Bonfri: | | | | | | | | | | | | |
| [1]16: | | | | | | | | | | | | |
| Bonfri part | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Lambeth part | Fair | Good | Fair | --- | Good | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| [1]17: | | | | | | | | | | | | |
| Bonfri part | Fair | Good | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Lambeth part | Fair | Good | Fair | --- | Good | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Garlet: | | | | | | | | | | | | |
| [1]18*: | | | | | | | | | | | | |
| Garlet part | Very poor. | Very poor. | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Sebud part | Very poor. | Very poor. | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very | Fair. |
| Glendive: | | | | | | | | | | | | |
| 19 | Fair | Good | Fair | --- | --- | Fair | Good | Poor | Fair | --- | Poor | Fair. |
| 20 | Poor | Fair | Fair | --- | --- | Fair | Good | Poor | Fair | --- | Fair | Fair. |
| Grail: | | | | | | | | | | | | |
| 21 | Good | Good | Fair | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 22 | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Harlem: | | | | | | | | | | | | |
| 23, 24 | Fair | Fair | Fair | --- | --- | Fair | Good | Good | Fair | --- | Good | Fair. |
| Havre: | | | | | | | | | | | | |
| 25, 26 | Fair | Fair | Fair | --- | --- | Fair | Good | Good | Fair | --- | Very poor. | Fair. |
| 27 | Good | Good | Good | --- | --- | Good | Good | Good | Good | --- | Good | Good. |
| Hilger: | | | | | | | | | | | | |
| [1]28*: | | | | | | | | | | | | |
| Hilger part | Poor | Poor | Good | --- | --- | Good | Poor | Very poor. | Poor | --- | Very poor. | Good. |

See footnote at end of table.

TABLE 3.--WILDLIFE HABITAT POTENTIALS--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | | Potential as habitat for-- | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife | Rangeland wildlife |
| Hilger--continued | | | | | | | | | | | | |
| Castner part | Very poor. | Very poor. | Poor | --- | Very poor. | Poor | Very poor. | Very poor. | Very poor. | --- | Very poor. | Poor. |
| Rock outcrop part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Kobar: | | | | | | | | | | | | |
| 29, 30 | Fair | Good | Fair | --- | Good | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Lambeth: | | | | | | | | | | | | |
| 31 | Fair | Good | Fair | --- | Good | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| [1]32: | | | | | | | | | | | | |
| Lambeth part | Fair | Good | Fair | --- | Good | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Rentsac part | Poor | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| [1]33: | | | | | | | | | | | | |
| Lambeth part | Fair | Good | Fair | --- | Good | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Yawdim part | Poor | Poor | Poor | --- | --- | Poor | Very poor. | Very poor. | Poor | --- | Very poor. | Poor. |
| Lardell: | | | | | | | | | | | | |
| 34* | Poor | Poor | Very poor. | --- | --- | Very poor. | Fair | Fair | Very poor. | --- | Fair | Very poor. |
| Lohler: | | | | | | | | | | | | |
| 35, 36 | Fair | Fair | Fair | --- | --- | Fair | Good | Good | Fair | --- | Good | Fair. |
| Lolo: | | | | | | | | | | | | |
| [1]37: | | | | | | | | | | | | |
| Lolo part | Fair | Fair | Good | Good | Good | Good | Poor | Very poor. | Fair | --- | Very poor. | Good. |
| Lolo part | Fair | Fair | Good | Good | Good | Good | Poor | Very poor. | Fair | --- | Very poor. | Good. |
| [1]38*: | | | | | | | | | | | | |
| Lolo part | Poor | Poor | Good | --- | --- | Good | Good | Poor | Fair | --- | Fair | Good. |
| Nesda part | Poor | Poor | Good | Fair | --- | Good | Good | Good | Fair | --- | Good | Good. |
| Lonna: | | | | | | | | | | | | |
| 39 | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 40 | Fair | Good | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair |
| McKenzie: | | | | | | | | | | | | |
| 41* | Very poor | Very poor | Very poor | --- | --- | Very poor | Good | Good | Very poor | --- | Good | Very poor. |
| Rentsac: | | | | | | | | | | | | |
| 42 | Poor | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Rock outcrop: | | | | | | | | | | | | |
| [1]43*: | | | | | | | | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Castner part | Poor | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |

See footnote at end of table.

TABLE 3.--WILDLIFE HABITAT POTENTIALS--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | | Potential as habitat for-- | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife | Rangeland wildlife |
| Rock outcrop: | | | | | | | | | | | | |
| 144*: | | | | | | | | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Garlet part | Very poor. | Very poor. | Good | --- | Good | --- | Very poor. | Very poor. | Poor | Good | Very poor. | --- |
| 145*: | | | | | | | | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Yawdim part | Very poor. | Very poor. | Poor | --- | --- | Poor | Very poor. | Very poor. | Very poor. | --- | Very poor. | Poor. |
| Sebud: | | | | | | | | | | | | |
| 46* | Poor | Fair | Good | --- | --- | Good | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 47* | Very poor. | Very poor. | Good | --- | Good | Good | Very poor. | Very poor. | Poor | Good | Very poor. | --- |
| 148*: | | | | | | | | | | | | |
| Sebud part | Very poor. | Very poor. | Good | --- | Good | Good | Very poor. | Very poor. | Poor | Good | Very poor. | --- |
| Cheadle part | Very poor. | Very poor. | Poor | --- | --- | Poor | Very poor. | Very poor. | Very poor. | --- | Very poor. | Poor. |
| Shane: | | | | | | | | | | | | |
| 49, 50 | Fair | Good | Fair | --- | Good | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 151: | | | | | | | | | | | | |
| Shane part | Fair | Good | Fair | --- | Good | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Cabba part | Fair | Good | Fair | --- | --- | Fair | --- | --- | --- | --- | --- | Fair. |
| Shawa: | | | | | | | | | | | | |
| 52 | Fair | Fair | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Tanna: | | | | | | | | | | | | |
| 53 | Fair | Good | Fair | --- | Good | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 54 | Fair | Fair | Fair | --- | Good | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 155: | | | | | | | | | | | | |
| Tanna part | Fair | Good | Fair | --- | Good | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Beenom part | Poor | Poor | Fair | --- | --- | Poor | Poor | Very poor. | Poor | --- | Very poor. | Fair. |
| 156: | | | | | | | | | | | | |
| Tanna part | Fair | Fair | Fair | --- | Good | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Rentsac part | Poor | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Rentsac part | Poor | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |

See footnote at end of table.

TABLE 3.--WILDLIFE HABITAT POTENTIALS--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | | Potential as habitat for-- | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife | Rangeland wildlife |
| Torrifluvents: [1]57*: | | | | | | | | | | | | |
| Torrifluvents part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Camborthids part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Turner: 58, 59, 60 | Fair | Fair | Good | --- | --- | Good | Very poor. | Very poor. | Fair | --- | Very poor. | Good. |
| Ustifluvents: [1]61*: | | | | | | | | | | | | |
| Ustifluvents part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Fluvaquents part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]62*: | | | | | | | | | | | | |
| Ustifluvents part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ustochrepts part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Wayden: [1]63*: | | | | | | | | | | | | |
| Wayden part | Very poor. | Very poor. | Poor | --- | --- | Fair | Very poor. | Very poor. | Very poor. | --- | Very poor. | Poor. |
| Castner part | Poor | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Winkler: [1]64*: | | | | | | | | | | | | |
| Winkler part | Very poor. | Very poor. | Fair | --- | Fair | Fair | Very poor. | Very poor. | Poor | Fair | Very poor. | --- |
| Hilger part | Poor | Poor | Good | --- | --- | Good | Poor | Very poor. | Poor | --- | Very poor. | Good. |
| Rock outcrop part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Work: 65 | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 66 | Fair | Good | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Yamac: 67, 68, 69, 70 | Fair | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Yawdim: [1]71*: | | | | | | | | | | | | |
| Yawdim part | Very poor. | Very poor. | Poor | --- | --- | Poor | Very poor. | Very poor. | Very poor. | --- | Very poor. | Poor. |
| Lambeth part | Very poor. | Very poor. | Fair | --- | Good | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Rock outcrop part | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 4.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Absarokee: | | | | |
| 1 | Moderate: percs slowly, too clayey. | Moderate: too clayey. | Moderate: slope, percs slowly, too clayey. | Moderate: too clayey. |
| 2 | Moderate: slope, percs slowly, too clayey. | Moderate: slope, too clayey. | Severe: slope. | Moderate: too clayey. |
| 13: | | | | |
| Absarokee part | Moderate: percs slowly, too clayey. | Moderate: too clayey. | Moderate: slope, percs slowly, too clayey. | Moderate: too clayey. |
| Sinnigam part | Moderate: too clayey. | Moderate: too clayey. | Severe: depth to rock. | Moderate: too clayey. |
| 14: | | | | |
| Absarokee part | Moderate: slope, percs slowly, too clayey. | Moderate: slope, too clayey. | Severe: slope. | Moderate: too clayey. |
| Sinnigam part | Moderate: slope, too clayey. | Moderate: slope, too clayey. | Severe: slope, depth to rock. | Moderate: too clayey. |
| 15*: | | | | |
| Absarokee part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Sinnigam part | Severe: slope. | Severe: slope. | Severe: slope, depth to rock. | Severe: slope. |
| 16: | | | | |
| Absarokee part | Moderate: percs slowly, too clayey. | Moderate: too clayey. | Severe: slope. | Moderate: too clayey. |
| Amherst part | Slight | Slight | Severe: slope, depth to rock. | Slight. |
| Castner part | Slight | Slight | Severe: depth to rock, slope. | Slight. |
| Absher: | | | | |
| 7 | Severe: percs slowly, dusty. | Severe: dusty. | Severe: percs slowly, dusty. | Severe: dusty. |
| Amherst: | | | | |
| 18: | | | | |
| Amherst part | Moderate: slope. | Moderate: slope. | Severe: slope, depth to rock. | Slight. |

See footnote at end of table.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Amherst--continued | | | | |
| Absarokee part | Moderate: slope, percs slowly, too clayey. | Moderate: slope, too clayey. | Severe: slope. | Moderate: too clayey. |
| Castner part | Moderate: slope. | Moderate: slope. | Severe: depth to rock, slope. | Slight. |
| Assinniboine: | | | | |
| 9 | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| [1]10: | | | | |
| Assinniboine part | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| Rentsac part | Moderate: slope, small stones. | Moderate: slope, small stones. | Severe: depth to rock, small stones, slope. | Moderate: small stones. |
| Attewan: | | | | |
| 11 | Slight | Slight | Moderate: slope. | Slight. |
| 12 | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]13: | | | | |
| Attewan part | Slight | Slight | Moderate: slope. | Slight. |
| Beaverell part | Moderate: small stones. | Moderate: small stones. | Severe: small stones. | Moderate: small stones. |
| Beaverell: | | | | |
| 14 | Severe: small stones. | Severe: small stones. | Severe: small stones. | Severe: small stones. |
| Birney: | | | | |
| [1]15*: | | | | |
| Birney part | Severe: slope. | Severe: slope. | Severe: slope, small stones. | Severe: slope. |
| Yawdim part | Severe: slope. | Severe: slope. | Severe: depth to rock, slope. | Severe: slope. |
| Rock outcrop part | --- | --- | --- | --- |
| Bonfri: | | | | |
| [1]16: | | | | |
| Bonfri part | Moderate: percs slowly. | Slight | Severe: slope. | Slight. |
| Lambeth part | Severe: percs slowly. | Moderate: dusty. | Severe: percs slowly. | Slight. |
| [1]17: | | | | |
| Bonfri part | Moderate: slope, percs slowly. | Moderate: slope. | Severe: slope. | Slight. |
| Lambeth part | Severe: percs slowly. | Moderate: slope, dusty. | Severe: slope, percs slowly. | Slight. |

See footnote at end of table.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Garlet: | | | | |
| [1]18*: | | | | |
| Garlet part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Sebud part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Glendive: | | | | |
| 19 | Moderate: dusty. | Moderate: dusty. | Moderate: slope, dusty. | Moderate: dusty. |
| 20 | Severe: floods. | Moderate: floods, dusty. | Moderate: floods, dusty. | Moderate: dusty. |
| Grail: | | | | |
| 21 | Moderate: too clayey, percs slowly. | Moderate: too clayey. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| 22 | Moderate: too clayey, percs slowly. | Moderate: too clayey. | Severe: slope. | Moderate: too clayey. |
| Harlem: | | | | |
| 23 | Moderate: too clayey, percs slowly. | Moderate: too clayey. | Moderate: too clayey, percs slowly. | Moderate: too clayey. |
| 24 | Severe: floods. | Moderate: floods, too clayey. | Moderate floods, too clayey. | Moderate: too clayey. |
| Havre: | | | | |
| 25 | Moderate: dusty. | Moderate: dusty. | Moderate: dusty. | Moderate: dusty. |
| 26 | Moderate: dusty. | Moderate: dusty. | Moderate: slope, dusty. | Moderate: dusty. |
| 27 | Severe: floods. | Moderate: floods. | Moderate: floods. | Slight. |
| Hilger: | | | | |
| [1]28*: | | | | |
| Hilger part | Severe: slope. | Severe: slope. | Severe: slope, small stones. | Severe: slope. |
| Castner part | Severe: slope. | Severe: slope. | Severe: slope, depth to rock, large stones. | Severe: slope. |
| Rock outcrop part | --- | --- | --- | --- |
| Kobar: | | | | |
| 29 | Moderate: percs slowly, too clayey. | Moderate: too clayey. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| 30 | Moderate: percs slowly, too clayey. | Moderate: too clayey. | Severe: slope. | Moderate: too clayey. |
| Lambeth: | | | | |
| 31 | Severe: percs slowly. | Moderate: slope, dusty. | Severe: slope, percs slowly. | Moderate: dusty. |

See footnote at end of table.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Lambeth: | | | | |
| [1]32: | | | | |
| Lambeth part | Moderate: dusty. | Moderate: slope, dusty. | Severe: slope, percs slowly. | Moderate: dusty. |
| Rentsac part | Moderate: slope. | Moderate: slope. | Severe: slope, depth to rock. | Slight. |
| [1]33: | | | | |
| Lambeth part | Moderate: dusty. | Moderate: slope, dusty. | Severe: slope, percs slowly. | Moderate: dusty. |
| Yawdim part | Moderate: too clayey. | Moderate: too clayey. | Severe: depth to rock, slope. | Moderate: too clayey. |
| Lardell: | | | | |
| 34* | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| Lohler: | | | | |
| 35, 36 | Moderate: too clayey, percs slowly. | Moderate: too clayey. | Moderate: too clayey, percs slowly. | Moderate: too clayey. |
| Lolo: | | | | |
| [1]37: | | | | |
| Lolo part | Moderate: small stones. | Moderate: small stones. | Severe: small stones. | Moderate: small stones. |
| Lolo part | Moderate: small stones. | Moderate: small stones. | Severe: small stones. | Moderate: small stones. |
| [1]38*: | | | | |
| Lolo part | Severe: small stones. | Severe: small stones. | Severe: small stones. | Severe: small stones. |
| Nesda part | Moderate: small stones. | Moderate: small stones. | Severe: small stones. | Moderate: small stones. |
| Lonna: | | | | |
| 39 | Slight | Slight | Moderate: slope. | Slight. |
| 40 | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| McKenzie: | | | | |
| 41* | Severe: floods, percs slowly, too clayey. | Severe: floods, too clayey. | Severe: floods, percs slowly, too clayey. | Severe: too clayey. |
| Rentsac: | | | | |
| 42 | Severe: slope. | Severe: slope. | Severe: slope, depth to rock. | Moderate: slope. |
| Rock outcrop: | | | | |
| [1]43*: | | | | |
| Rock outcrop part | --- | --- | --- | --- |
| Castner part | Severe: slope. | Severe: slope. | Severe: depth to rock, slope. | Severe: slope. |
| [1]44*: | | | | |
| Rock outcrop part | --- | --- | --- | --- |

See footnote at end of table.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Rock outcrop--continued | | | | |
| Garlet part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| [1]45*: | | | | |
| Rock outcrop part | --- | --- | --- | --- |
| Yawdim part | Severe: slope. | Severe: slope. | Severe: depth to rock, slope. | Severe: slope. |
| Sebud: | | | | |
| 46* | Moderate: slope, small stones, large stones. | Moderate: slope, small stones, large stones. | Severe: slope, large stones, small stones. | Moderate: small stones, large stones. |
| 47* | Severe: slope. | Severe: slope. | Severe: slope, large stones, small stones. | Severe: slope. |
| [1]48*: | | | | |
| Sebud part | Severe: slope. | Severe: slope. | Severe: slope, large stones, small stones. | Severe: slope. |
| Cheadle part | Severe: slope. | Severe: slope. | Severe: slope, depth to rock. | Severe: slope. |
| Shane: | | | | |
| 49 | Severe: percs slowly. | Moderate: too clayey. | Severe: slope, percs slowly. | Moderate: too clayey. |
| 50 | Severe: percs slowly. | Moderate: slope, too clayey. | Severe: slope, percs slowly. | Moderate: too clayey. |
| [1]51: | | | | |
| Shane part | Severe: percs slowly. | Moderate: too clayey. | Severe: slope, percs slowly. | Moderate: too clayey. |
| Cabba part | Moderate: too clayey. | Moderate: too clayey. | Severe: slope, depth to rock. | Moderate: too clayey. |
| Shawa: | | | | |
| 52 | Moderate: too clayey. | Moderate: too clayey. | Moderate: slope, too clayey. | Moderate: too clayey. |
| Tanna: | | | | |
| 53 | Moderate: percs slowly, too clayey. | Moderate: too clayey. | Moderate: slope, depth to rock, too clayey. | Moderate: too clayey. |
| 54 | Moderate: slope, percs slowly, too clayey. | Moderate: slope, too clayey. | Severe: slope. | Moderate: too clayey. |
| [1]55: | | | | |
| Tanna part | Moderate: percs slowly, too clayey. | Moderate: too clayey. | Severe: slope. | Moderate: too clayey. |

See footnote at end of table.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Tanna--continued | | | | |
| Beenom part | Slight | Slight | Severe: slope, depth to rock. | Slight. |
| [1]56: | | | | |
| Tanna part | Moderate: slope, percs slowly, too clayey. | Moderate: slope, too clayey. | Severe: slope. | Moderate: too clayey. |
| Rentsac part | Moderate: slope. | Moderate: slope. | Severe: slope, depth to rock. | Slight. |
| Rentsac part | Moderate: slope, small stones. | Moderate: slope, small stones. | Severe: small stones, slope. | Moderate: small stones. |
| Torrifluvents: | | | | |
| [1]57*: | | | | |
| Torrifluvents part | --- | --- | --- | --- |
| Camborthids part | --- | --- | --- | --- |
| Turner: | | | | |
| 58 | Moderate: too clayey. | Moderate: too clayey. | Moderate: slope, too clayey. | Moderate: too clayey. |
| 59 | Moderate: too clayey. | Moderate: too clayey. | Severe: slope. | Moderate: too clayey. |
| 60 | Moderate: slope, too clayey, large stones. | Moderate: slope, too clayey, large stones. | Severe: slope, large stones. | Moderate: large stones, too clayey, large stones. |
| Ustifluvents: | | | | |
| [1]61*: | | | | |
| Ustifluvents part | --- | --- | --- | --- |
| Fluvaquents part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]62*: | | | | |
| Ustifluvents part | --- | --- | --- | --- |
| Ustochrepts part | --- | --- | --- | --- |
| Wayden: | | | | |
| [1]63*: | | | | |
| Wayden part | Severe: slope. | Severe: slope. | Severe: depth to rock, slope. | Severe: slope. |
| Castner part | Severe: slope. | Severe: slope. | Severe: depth to rock, slope. | Severe: slope. |
| Winkler: | | | | |
| [1]64*: | | | | |
| Winkler part | Severe: slope. | Severe: slope. | Severe: slope, small stones. | Severe: slope. |
| Hilger part | Severe: slope. | Severe: sl pe. | Severe: slope, small stones. | Severe: slope. |

See footnote at end of table.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Winkler: Rock outcrop part-- | --- | --- | --- | --- |
| Work: 65 | Slight | Slight | Severe: slope. | Slight. |
| 66 | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| Yamac: 67 | Slight | Slight | Slight | Slight. |
| 68 | Slight | Slight | Moderate: slope. | Slight. |
| 69 | Slight | Slight | Severe: slope. | Slight. |
| 70 | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| Yawdim: [1]71*: Yawdim part | Severe: slope. | Severe: slope. | Severe: depth to rock, slope. | Severe: slope. |
| Lambeth part | Severe: slope. | Severe: slope. | Severe: slope, percs slowly. | Severe: slope. |
| Rock outcrop part. | | | | |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 5.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Absarokee: | | | | | |
| 1 | Severe: depth to rock, too clayey. | Severe: shrink-swell, low strength. | Severe: depth to rock, low strength, shrink-swell. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| 2 | Severe: depth to rock, too clayey. | Severe: shrink-swell, low strength. | Severe: depth to rock, low strength, shrink-swell. | Severe: slope, low strength, shrink-swell. | Severe: shrink-swell, low strength. |
| 3: | | | | | |
| Absarokee part | Severe: depth to rock, too clayey. | Severe: shrink-swell, low strength. | Severe: depth to rock, low strength, shrink-swell. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| Sinnigam part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. |
| 4: | | | | | |
| Absarokee part | Severe: depth to rock, too clayey. | Severe: shrink-swell, low strength. | Severe: depth to rock, low strength, shrink-swell. | Severe: slope, low strength, shrink-swell. | Severe: shrink-swell, low strength. |
| Sinnigam part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. |
| 5*: | | | | | |
| Absarokee part | Severe: slope, depth to rock, too clayey. | Severe: slope, shrink-swell, low strength. | Severe: slope, depth to rock, shrink-swell. | Severe: slope, low strength, shrink-swell. | Severe: slope, shrink-swell, low strength. |
| Sinnigam part | Severe: slope, depth to rock, small stones. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock, |
| 6: | | | | | |
| Absarokee part | Severe: depth to rock, too clayey. | Severe: shrink-swell, low strength. | Severe: depth to rock, low strength, shrink-swell. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| Amherst part | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock, low strength. |
| Castner part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. |
| Absher: | | | | | |
| 7 | Severe: too clayey. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| Amherst: | | | | | |
| 8: | | | | | |
| Amherst part | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock, low strength. |

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Amherst--continued | | | | | |
| Absarokee part | Severe: depth to rock, too clayey. | Severe: shrink-swell, low strength. | Severe: depth to rock, low strength, shrink-swell. | Severe: slope, low strength, shrink-swell. | Severe: shrink-swell, low strength. |
| Castner part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. |
| Assinniboine: | | | | | |
| 9 | Moderate: slope. | Moderate: slope. | Moderate: slope, shrink-swell. | Severe: slope. | Moderate: slope, frost action. |
| [1]10: | | | | | |
| Assinniboine part | Moderate: slope. | Moderate: slope. | Moderate: slope, shrink-swell. | Severe: slope. | Moderate: slope, frost action. |
| Rentsac part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. |
| Attewan: | | | | | |
| 11 | Severe: cutbanks cave, small stones. | Moderate: frost action. | Slight | Slight | Moderate: frost action, low strength. |
| 12 | Severe: wetness, cutbanks cave, small stones. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]13: | | | | | |
| Attewan part | Severe: cutbanks cave, small stones. | Slight | Slight | Slight | Moderate: frost action, low strength. |
| Beaverell part | Severe: cutbanks cave, small stones, too sandy. | Slight | Slight | Slight | Moderate: frost action. |
| Beaverell: | | | | | |
| 14 | Severe: cutbanks cave, small stones, too sandy. | Slight | Slight | Moderate: slope. | Moderate: frost action. |
| Birney: | | | | | |
| [1]15*: | | | | | |
| Birney part | Severe: slope, small stones. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Yawdim part | Severe: too clayey, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength, slope. |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Bonfri: | | | | | |
| [1]16: | | | | | |
| Bonfri part | Moderate: depth to rock, too clayey. | Moderate: shrink-swell. | Moderate: depth to rock, shrink-swell. | Moderate: slope, shrink-swell. | Severe: low strength. |

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Bonfri--continued | | | | | |
| Lambeth part----- | Slight---------- | Slight---------- | Slight---------- | Moderate: slope. | Moderate: frost action, low strength. |
| 117: | | | | | |
| Bonfri part------ | Moderate: slope, depth to rock, too clayey. | Moderate: slope, shrink-swell. | Moderate: slope, depth to rock, shrink-swell. | Severe: slope. | Severe: low strength. |
| Lambeth part----- | Moderate: slope. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope, frost action, low strength. |
| Garlet: | | | | | |
| 118*: | | | | | |
| Garlet part------ | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Sebud part------- | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Glendive: | | | | | |
| 19---------- | Slight---------- | Severe: floods. | Severe: floods. | Severe: floods. | Moderate: frost action, floods, low strength. |
| 20---------- | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. |
| Grail: | | | | | |
| 21, 22---------- | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. |
| Harlem: | | | | | |
| 23---------- | Severe: too clayey. | Severe: floods, shrink-swell, low strength. | Severe: floods, shrink-swell, low strength. | Severe: floods, shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| 24---------- | Severe: too clayey, floods. | Severe: floods, shrink-swell, low strength. | Severe: floods, shrink-swell, low strength. | Severe: floods, shrink-swell, low strength. | Severe: floods, shrink-swell, low strength. |
| Havre: | | | | | |
| 25, 26---------- | Moderate: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Moderate: frost action, low strength. |
| 27---------- | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. |
| Hilger: | | | | | |
| 128*: | | | | | |
| Hilger part------ | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Castner part----- | Severe: depth to rock, slope, small stones. | Severe: depth to rock, slope. | Severe: depth to rock, slope. | Severe: depth to rock, slope. | Severe: depth to rock, slope. |
| Rock outcrop part---------- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Kobar: | | | | | |
| 29, 30 | Severe: too clayey. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| Lambeth: | | | | | |
| 31 | Moderate: slope. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope, frost action, low strength. |
| [1]32: | | | | | |
| Lambeth part | Moderate: slope. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope, frost action, low strength. |
| Rentsac part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock |
| [1]33: | | | | | |
| Lambeth part | Moderate: slope. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope, frost action, low strength. |
| Yawdim part | Moderate: too clayey. depth to rock. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| Lardell: | | | | | |
| 34* | Severe: wetness, cutbanks cave. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: wetness. |
| Lohler: | | | | | |
| 35, 36 | Severe: too clayey. | Severe: low strength, floods, shrink-swell. | Severe: low strength, floods, shrink-swell. | Severe: low strength, floods, shrink-swell. | Severe: low strength, floods, shrink-swell. |
| Lolo: | | | | | |
| [1]37: | | | | | |
| Lolo part | Severe: small stones. | Slight | Slight | Slight | Moderate: frost action, low strength. |
| Lolo part | Severe: small stones. | Slight | Slight | Slight | Moderate: frost action, low strength. |
| [1]38*: | | | | | |
| Lolo part | Severe: floods, small stones, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. |
| Nesda part | Severe: floods, small stones, cutbanks cave. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. |
| Lonna: | | | | | |
| 39 | Slight | Moderate: shrink-swell, low strength. | Moderate: shrink-swell, low strength. | Moderate: slope, shrink-swell, low strength. | Moderate: low strength, shrink-swell, frost action. |

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Lonna: | | | | | |
| 40 | Moderate: slope. | Moderate: slope, shrink-swell, low strength. | Moderate: slope, shrink-swell, low strength. | Severe: slope. | Moderate: slope, shrink-swell, low strength. |
| McKenzie: | | | | | |
| 41* | Severe: floods, too clayey. | Severe: floods, low strength, shrink-swell. | Severe: floods, low strength, shrink-swell. | Severe: floods, low strength, shrink-swell. | Severe: low strength, shrink-swell, floods. |
| Rentsac: | | | | | |
| 42 | Severe: slope, depth to rock, small stones. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. |
| Rock outcrop: | | | | | |
| 143*: | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Castner part | Severe: slope, depth to rock, small stones. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock, slope. |
| 144*: | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Garlet part | Severe: slope, cutbanks cave, small stones. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| 145*: | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Yawdim part | Severe: slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. |
| Sebud: | | | | | |
| 46* | Moderate: large stones, slope, too clayey. | Moderate: large stones, slope. | Moderate: slope, large stones, shrink-swell. | Severe: slope. | Moderate: slope, frost action, low strength. |
| 47* | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| 148*: | | | | | |
| Sebud part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Cheadle part | Severe: slope, depth to rock, small stones. | Severe: slope, depth to rock. | Severe: depth to rock, slope. | Severe: slope, depth to rock. | Severe: slope, depth to rock. |
| Shane: | | | | | |
| 49 | Severe: too clayey. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: low strength, shrink-swell. | Severe: shrink-swell, low strength. |

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Shane: | | | | | |
| 50 | Severe: too clayey. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: slope, low strength, shrink-swell. | Severe: shrink-swell, low strength. |
| [1]51: | | | | | |
| Shane part | Severe: too clayey. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: low strength, shrink-swell. | Severe: shrink-swell, low strength. |
| Cabba part | Moderate: depth to rock. | Moderate: frost action, depth to rock. | Moderate: depth to rock. | Moderate: slope, depth to rock, frost action. | Moderate: frost action, depth to rock. |
| Shawa: | | | | | |
| 52 | Moderate: too clayey. | Moderate: low strength, shrink-swell. | Moderate: low strength, shrink-swell. | Moderate: slope, low strength, shrink-swell. | Moderate: low strength, frost action, shrink-swell. |
| Tanna: | | | | | |
| 53 | Moderate: depth to rock, too clayey. | Moderate: shrink-swell, low strength. | Moderate: depth to rock, shrink-swell. | Moderate: slope, shrink-swell, low strength. | Severe: low strength. |
| 54 | Moderate: slope, depth to rock, too clayey. | Moderate: slope, shrink-swell, low strength. | Moderate: depth to rock, shrink-swell, slope. | Severe: slope. | Severe: low strength. |
| [1]55: | | | | | |
| Tanna part | Moderate: depth to rock, too clayey. | Moderate: shrink-swell, low strength. | Moderate: depth to rock, shrink-swell. | Moderate: slope, shrink-swell, low strength. | Severe: low strength. |
| Beenom part | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. |
| [1]56: | | | | | |
| Tanna part | Moderate: slope, depth to rock, too clayey. | Moderate: slope, shrink-swell, low strength. | Moderate: depth to rock, shrink-swell, slope. | Severe: slope. | Severe: low strength. |
| Rentsac part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. |
| Rentsac part | Severe: depth to rock, small stones. | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. |
| Torrifluvents: | | | | | |
| [1]57*: | | | | | |
| Torrifluvents part | --- | Severe: floods. | Severe: floods. | Severe: floods. | --- |
| Camborthids part | --- | --- | --- | --- | --- |
| Turner: | | | | | |
| 58 | Severe: small stones, cutbanks cave. | Moderate: shrink-swell, low strength. | Moderate: shrink-swell. | Moderate: frost action, low strength, shrink-swell. | Severe: low strength. |

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Turner: | | | | | |
| 59 | Severe: small stones, cutbanks cave. | Moderate: shrink-swell, low strength. | Moderate: shrink-swell. | Moderate: slope, low strength. | Severe: low strength. |
| 60 | Severe: small stones, cutbanks cave. | Moderate: slope, large stones. | Moderate: slope, large stones. | Severe: slope. | Severe: low strength. |
| Ustifluvents: | | | | | |
| [1]61*: | | | | | |
| Ustifluvents part | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. |
| Fluvaquents part | Severe: floods. | Severe: wetness, floods. | Severe: wetness, floods. | Severe: wetness, floods. | Severe: floods. |
| [1]62*: | | | | | |
| Ustifluvents part | --- | Severe: floods. | Severe: floods. | Severe: floods. | --- |
| Ustochrepts part | --- | --- | --- | --- | --- |
| Wayden: | | | | | |
| [1]63*: | | | | | |
| Wayden part | Severe: slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. |
| Castner part | Severe: slope, depth to rock, small stones. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock, slope. |
| Winkler: | | | | | |
| [1]64*: | | | | | |
| Winkler part | Severe: slope, cutbanks cave, small stones. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Hilger part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Rock outcrop part | --- | --- | --- | --- | |
| Work: | | | | | |
| 65 | Moderate: too clayey low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| 66 | Moderate: slope, too clayey. | Severe: shrink-swell, low strength. | Severe: shrink-swell, low strength. | Severe: slope, shrink-swell, low strength. | Severe: shrink-swell, low strength. |
| Yamac: | | | | | |
| 67, 68 | Slight | Moderate: low strength. | Moderate: low strength. | Moderate: low strength. | Moderate: frost action, low strength. |
| 69 | Slight | Moderate: low strength. | Moderate: low strength. | Moderate: slope, low strength. | Moderate: frost action, low strength. |

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Yamac: 70 | Slight | Moderate: slope, low strength. | Moderate: slope, low strength. | Severe: slope. | Moderate: slope, frost action, low strength. |
| Yawdim: [1]71*: | | | | | |
| Yawdim part | Severe: too clayey, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. | Severe: shrink-swell, low strength, slope. |
| Lambeth part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Rock outcrop part | --- | --- | --- | --- | --- |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 6.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Absarokee: | | | | | |
| 1 | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Slight | Poor: too clayey. |
| 2 | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock, too clayey. | Moderate: slope. | Poor: too clayey. |
| 13: | | | | | |
| Absarokee part | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Slight | Poor: too clayey. |
| Sinnigam part | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock. | Slight | Poor: thin layer, area reclaim, small stones. |
| 14: | | | | | |
| Absarokee part | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock, too clayey. | Moderate: slope. | Poor: too clayey. |
| Sinnigam part | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock. | Moderate: slope. | Poor: thin layer, area reclaim, small stones. |
| 15*: | | | | | |
| Absarokee part | Severe: slope, depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: slope, depth to rock, too clayey. | Severe: slope. | Poor: slope, too clayey. |
| Sinnigam part | Severe: slope, depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope. | Poor: slope, thin layer, area reclaim. |
| 16: | | | | | |
| Absarokee part | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Slight | Poor: too clayey. |
| Amherst part | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Poor: thin layer, area reclaim. |
| Castner part | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Poor: thin layer, small stones, area reclaim. |
| Absher: | | | | | |
| 7 | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, area reclaim. |
| Amherst: | | | | | |
| 18: | | | | | |
| Amherst part | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. | Moderate: slope. | Poor: thin layer, area reclaim. |

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Amherst--continued | | | | | |
| Absarokee part | Severe: percs slowly, depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock, too clayey. | Moderate: slope. | Poor: too clayey. |
| Castner part | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. | Moderate: slope. | Poor: thin layer, small stones, area reclaim. |
| Assinniboine: | | | | | |
| 9 | Moderate: slope. | Severe: slope, seepage. | Severe: seepage. | Severe: seepage. | Fair: slope. |
| [1]10: | | | | | |
| Assinniboine part | Moderate: slope. | Severe: slope, seepage. | Severe: seepage. | Severe: seepage. | Fair: slope. |
| Rentsac part | Severe: depth to rock. | Severe: slope, depth to rock, seepage. | Severe: depth to rock, seepage. | Severe: seepage. | Poor: small stones, thin layer, area reclaim. |
| Attewan: | | | | | |
| 11 | Slight | Severe: seepage. | Severe: seepage, small stones, too sandy. | Severe: seepage. | Fair: small stones. |
| 12 | Severe: wetness. | Severe: wetness, seepage. | Severe: wetness, seepage, small stones. | Severe: wetness. | Poor: wetness. |
| [1]13: | | | | | |
| Attewan part | Slight | Severe: seepage. | Severe: seepage, small stones. | Severe: seepage. | Fair: small stones. |
| Beaverell part | Slight | Severe: seepage. | Severe: seepage, small stones, too sandy. | Severe: seepage. | Poor: too sandy, small stones. |
| Beaverell: | | | | | |
| 14 | Slight | Severe: seepage. | Severe: seepage, small stones, too sandy. | Severe: seepage. | Poor: too sandy, small stones. |
| Birney: | | | | | |
| [1]15*: | | | | | |
| Birney part | Severe: slope. | Severe: slope, seepage. | Severe: seepage. | Severe: slope, seepage. | Poor: slope, small stones. |
| Yawdim part | Severe: percs slowly, slope, depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey, slope. | Severe: slope. | Poor: too clayey, thin layer, slope. |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Bonfri: | | | | | |
| [1]16: | | | | | |
| Bonfri part | Severe: percs slowly, depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Fair: thin layer, area reclaim. |

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Bonfri--continued | | | | | |
| Lambeth part | Severe: percs slowly. | Moderate: slope. | Slight | Slight | Good. |
| [1]17: | | | | | |
| Bonfri part | Severe: percs slowly, depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. | Moderate: slope. | Fair: slope, thin layer. |
| Lambeth part | Severe: percs slowly. | Severe: slope. | Slight | Moderate: slope. | Fair: slope. |
| Garlet: | | | | | |
| [1]18*: | | | | | |
| Garlet part | Severe: slope. | Severe: slope, seepage. | Severe: slope, seepage. | Severe: slope, seepage. | Poor: slope, small stones. |
| Sebud part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: slope. |
| Glendive: | | | | | |
| 19 | Moderate: floods. | Severe: seepage, floods. | Severe: seepage. | Severe: seepage. | Good. |
| 20 | Severe: floods. | Severe: seepage, floods. | Severe: seepage, floods. | Severe: seepage, floods. | Good. |
| Grail: | | | | | |
| 21, 22 | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| Harlem: | | | | | |
| 23 | Severe: percs slowly. | Slight | Moderate: floods. | Moderate: floods. | Poor: too clayey. |
| 24 | Severe: percs slowly, floods. | Severe: floods. | Severe: floods. | Severe: floods. | Poor: too clayey. |
| Havre: | | | | | |
| 25, 26 | Moderate: percs slowly, floods. | Severe: floods. | Moderate: floods. | Moderate: floods. | Good. |
| 27 | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Good. |
| Hilger: | | | | | |
| [1]28*: | | | | | |
| Hilger part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: small stones, slope. |
| Castner part | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope. | Poor: slope, thin layer, area reclaim. |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Kobar: | | | | | |
| 29, 30 | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Lambeth: | | | | | |
| 31 | Severe: percs slowly. | Severe: slope. | Slight | Moderate: slope. | Fair: slope. |

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Lambeth--continued | | | | | |
| [1]32: | | | | | |
| Lambeth part | Severe: percs slowly. | Severe: slope. | Slight | Moderate: slope. | Fair: slope. |
| Rentsac part | Severe: depth to rock. | Severe: slope, depth to rock, seepage. | Severe: depth to rock, seepage. | Severe: seepage. | Poor: thin layer, small stones, area reclaim. |
| [1]33: | | | | | |
| Lambeth part | Severe: percs slowly. | Severe: slope. | Slight | Moderate: slope. | Fair: slope. |
| Yawdim part | Severe: percs slowly, depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey. | Moderate: slope. | Poor: too clayey, thin layer. |
| Lardell: | | | | | |
| 34* | Severe: percs slowly, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Fair: too clayey, wetness. |
| Lohler: | | | | | |
| 35, 36 | Severe: percs slowly. | Severe: floods. | Severe: too clayey. | Moderate: floods. | Poor: too clayey. |
| Lolo: | | | | | |
| [1]37: | | | | | |
| Lolo part | Slight | Severe: seepage, small stones. | Severe: seepage. | Severe: seepage. | Poor: small stones, seepage. |
| Lolo part | Slight | Severe: seepage, small stones. | Severe: seepage. | Severe: seepage. | Poor: small stones, seepage. |
| [1]38*: | | | | | |
| Lolo part | Severe: floods, wetness. | Severe: seepage, floods, wetness. | Severe: seepage, floods, wetness. | Severe: seepage, floods, wetness. | Poor: seepage, small stones, wetness. |
| Nesda part | Severe: floods. | Severe: floods, seepage, small stones. | Severe: floods, small stones, seepage. | Severe: floods, seepage. | Poor: small stones, too sandy. |
| Lonna: | | | | | |
| 39 | Moderate: percs slowly. | Moderate: seepage, slope. | Slight | Slight | Good. |
| 40 | Moderate: percs slowly, slope. | Severe: slope. | Slight | Moderate: slope. | Fair: slope. |
| McKenzie: | | | | | |
| 41* | Severe: percs slowly, floods. | Slight | Severe: floods, too clayey. | Severe: floods. | Poor: too clayey. |
| Rentsac: | | | | | |
| 42 | Severe: slope, depth to rock. | Severe: slope, depth to rock, seepage. | Severe: depth to rock, seepage. | Severe: slope, seepage. | Poor: thin layer, slope, area reclaim. |

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Rock outcrop: | | | | | |
| [1]43*: | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Castner part | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope. | Poor: slope, thin layer, small stones. |
| [1]44*: | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Garlet part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: slope, small stones. |
| [1]45*: | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Yawdim part | Severe: percs slowly, slope, depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey, slope. | Severe: slope. | Poor: too clayey, thin layer, slope. |
| Sebud: | | | | | |
| 46* | Moderate: slope, large stones, percs slowly. | Severe: slope, large stones. | Moderate: large stones, too clayey. | Moderate: slope. | Fair: slope, large stones, too clayey. |
| 47* | Severe: slope. | Severe: slope, large stones. | Severe: slope. | Severe: slope. | Poor: slope. |
| [1]48*: | | | | | |
| Sebud part | Severe: slope. | Severe: slope, large stones. | Severe: slope. | Severe: slope. | Poor: slope. |
| Cheadle part | Severe: slope, depth to rock. | Severe: slope, depth to rock, large stones. | Severe: slope, depth to rock. | Severe: slope. | Poor: slope, small stones, thin layer. |
| Shane: | | | | | |
| 49 | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Slight | Poor: too clayey, hard to pack, thin layer. |
| 50 | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock, too clayey. | Moderate: slope. | Poor: too clayey, hard to pack, thin layer. |
| [1]51: | | | | | |
| Shane part | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock, too clayey. | Slight | Poor: too clayey, hard to pack, thin layer. |
| Cabba part | Severe: depth to rock. | Severe: slope, depth to rock. | Severe: depth to rock. | Slight | Poor: thin layer, area reclaim. |

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Shawa: | | | | | |
| 52 | Moderate: percs slowly. | Moderate: slope, seepage. | Slight | Slight | Fair: too clayey. |
| Tanna: | | | | | |
| 53 | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock. | Slight | Fair: thin layer, too clayey, small stones. |
| 54 | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock. | Moderate: slope. | Fair: slope, thin layer, too clayey. |
| 155: | | | | | |
| Tanna part | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock. | Slight | Fair: thin layer, too clayey, small stones. |
| Beenom part | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Poor: thin layer, area reclaim. |
| 156: | | | | | |
| Tanna part | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock. | Moderate: slope. | Fair: slope, thin layer, too clayey. |
| Rentsac part | Severe: depth to rock. | Severe: slope, depth to rock, seepage. | Severe: depth to rock, seepage. | Severe: seepage. | Poor: thin layer, small stones, area reclaim. |
| Rentsac part | Severe: depth to rock. | Severe: slope, depth to rock, seepage. | Severe: depth to rock, seepage. | Severe: seepage. | Poor: small stones, thin layer, area reclaim. |
| Torrifluvents: | | | | | |
| 157*: | | | | | |
| Torrifluvents part | Moderate: floods. | --- | Moderate: floods. | Moderate: floods. | --- |
| Camborthids part | --- | --- | --- | --- | --- |
| Turner: | | | | | |
| 58, 59 | Slight | Severe: seepage, small stones. | Severe: seepage, small stones. | Severe: seepage. | Poor: small stones. |
| 60 | Moderate: slope, large stones. | Severe: slope, seepage, large stones. | Severe: seepage, small stones. | Severe: seepage. | Fair: large stones, slope, too clayey. |
| Ustifluvents: | | | | | |
| 161*: | | | | | |
| Ustifluvents part | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | --- |
| Fluvaquents part | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | --- |

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Ustifluvents: [1]62*: | | | | | |
| Ustifluvents part | Moderate: floods. | Severe: floods. | Moderate: floods. | Moderate: floods. | --- |
| Ustochrepts part | --- | --- | --- | --- | --- |
| Wayden: [1]63*: | | | | | |
| Wayden part | Severe: percs slowly, depth to rock, slope. | Severe: depth to rock, slope. | Severe: depth to rock, slope. slope. | Severe: slope. | Poor: thin layer, area reclaim, slope. |
| Castner part | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope, depth to rock. | Severe: slope. | Poor: slope, thin layer, small stones. |
| Winkler: [1]64*: | | | | | |
| Winkler part | Severe: slope. | Severe: slope, seepage, small stones. | Severe: slope, seepage. | Severe: slope, seepage. | Poor: slope, small stones, seepage. |
| Hilger part | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: small stones, slope. |
| Rock outcrop part | --- | --- | --- | --- | --- |
| Work: | | | | | |
| 65 | Moderate: percs slowly. | Moderate: slope, seepage. | Slight | Slight | Fair: too clayey. |
| 66 | Moderate: slope, percs slowly. | Severe: slope. | Slight | Moderate: slope. | Fair: slope, too clayey. |
| Yamac: | | | | | |
| 67 | Moderate: percs slowly. | Moderate: seepage. | Slight | Slight | Good. |
| 68, 69 | Moderate: percs slowly. | Moderate: slope, seepage. | Slight | Slight | Good. |
| 70 | Moderate: slope, percs slowly. | Severe: slope. | Slight | Moderate: slope. | Fair: slope. |
| Yawdim: [1]71*: | | | | | |
| Yawdim part | Severe: percs slowly, slope, depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey, slope. | Severe: slope. | Poor: too clayey, thin layer, slope. |
| Lambeth part | Severe: slope, percs slowly. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: slope. |
| Rock outcrop part | --- | --- | --- | --- | --- |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 7.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Absarokee: | | | | |
| 1, 2 | Poor: shrink-swell, low strength, thin layer. | Unsuited | Unsuited | Poor: too clayey. |
| 3: | | | | |
| Absarokee part | Poor: shrink-swell, low strength, thin layer. | Unsuited | Unsuited | Poor: too clayey. |
| Sinnigam part | Poor: thin layer, area reclaim. | Unsuited | Unsuited | Poor: thin layer, small stones. |
| 4: | | | | |
| Absarokee part | Poor: shrink-swell, low strength, thin layer. | Unsuited | Unsuited | Poor: too clayey. |
| Sinnigam part | Poor: thin layer, area reclaim. | Unsuited | Unsuited | Poor: thin layer, small stones. |
| 5*: | | | | |
| Absarokee part | Poor: slope, thin layer, low strength. | Unsuited | Unsuited | Poor: slope, too clayey. |
| Sinnigam part | Poor: slope, thin layer. | Unsuited | Unsuited | Poor: slope, thin layer, small stones. |
| 6: | | | | |
| Absarokee part | Poor: shrink-swell, low strength, thin layer. | Unsuited | Unsuited | Poor: too clayey. |
| Amherst part | Poor: thin layer, low strength. | Unsuited | Unsuited | Poor: thin layer, area reclaim. |
| Castner part | Poor: thin layer, area reclaim. | Unsuited | Unsuited | Poor: small stones, thin layer. |
| Absher: | | | | |
| 7 | Poor: shrink-swell, low strength, area reclaim. | Unsuited | Unsuited | Poor: area reclaim, too clayey, excess salt. |
| Amherst: | | | | |
| 8: | | | | |
| Amherst part | Poor: thin layer, low strength. | Unsuited | Unsuited | Poor: thin layer, area reclaim. |

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Amherst--continued | | | | |
| Absarokee part | Poor: shrink-swell, low strength, thin layer. | Unsuited | Unsuited | Poor: too clayey. |
| Castner part | Poor: thin layer, area reclaim. | Unsuited | Unsuited: thin layer. | Poor: small stones, thin layer. |
| Assinniboine: | | | | |
| 9 | Fair: frost action. | Poor: excess fines. | Unsuited | Fair: slope. |
| [1]10: | | | | |
| Assinniboine part | Fair: frost action. | Poor: excess fines. | Unsuited | Fair: slope. |
| Rentsac part | Poor: depth to rock, thin layer. | Unsuited | Unsuited: thin layer. | Poor: thin layer, area reclaim, small stones. |
| Attewan: | | | | |
| 11 | Good | Poor: excess fines. | Good | Fair: small stones. |
| 12 | Good | Poor: excess fines. | Good | Fair: small stones. |
| [1]13: | | | | |
| Attewan part | Good | Poor: excess fines. | Good | Fair: small stones. |
| Beaverell part | Good | Good | Good | Poor: small stones. |
| Beaverell: | | | | |
| 14 | Good | Good | Good | Poor: small stones. |
| Birney: | | | | |
| [1]15*: | | | | |
| Birney part | Poor: slope. | Unsuited | Fair: excess fines. | Poor: small stones, slope. |
| Yawdim part | Poor: low strength, shrink-swell, slope. | Unsuited | Unsuited | Poor: too clayey, area reclaim. |
| Rock outcrop part | --- | --- | --- | --- |
| Bonfri: | | | | |
| [1]16: | | | | |
| Bonfri part | Poor: low strength. | Unsuited | Unsuited | Poor: thin layer. |
| Lambeth part | Fair: frost action, low strength. | Unsuited | Unsuited | Good. |
| [1]17: | | | | |
| Bonfri part | Poor: low strength. | Unsuited | Unsuited | Poor: thin layer. |
| Lambeth part | Fair: frost action, low strength. | Unsuited | Unsuited | Fair: slope. |

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Garlet: | | | | |
| [1]18*: | | | | |
| Garlet part | Poor: slope. | Unsuited | Unsuited | Poor: large stones, slope. |
| Sebud part | Poor: slope. | Unsuited | Unsuited | Poor: large stones, slope. |
| Glendive: | | | | |
| 19 | Fair: frost action. | Poor: excess fines. | Unsuited | Fair: excess salt. |
| 20 | Fair: frost action. | Poor: excess fines. | Unsuited | Fair: excess salt. |
| Grail: | | | | |
| 21, 22 | Fair: frost action. | Unsuited | Unsuited | Fair: too clayey. |
| Harlem: | | | | |
| 23 | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Fair: thin layer, too clayey. |
| 24 | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Fair: too clayey. |
| Havre: | | | | |
| 25, 26 | Fair: frost action, low strength. | Unsuited | Unsuited | Good. |
| 27 | Fair: frost action, low strength. | Unsuited | Unsuited | Good. |
| Hilger: | | | | |
| [1]28*: | | | | |
| Hilger part | Poor: slope. | Unsuited | Unsuited | Poor: slope, small stones, thin layer. |
| Castner part | Poor: thin layer, slope, area reclaim. | Unsuited | Unsuited | Poor: slope, large stones, thin layer. |
| Rock outcrop part | --- | --- | --- | --- |
| Kobar: | | | | |
| 29, 30 | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: thin layer, too clayey. |
| Lambeth: | | | | |
| 31 | Fair: frost action, low strength. | Unsuited | Unsuited | Fair: slope. |
| [1]32: | | | | |
| Lambeth part | Fair: frost action, low strength. | Unsuited | Unsuited | Fair: slope. |

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Lambeth--continued | | | | |
| Rentsac part | Poor: depth to rock, area reclaim. | Unsuited | Unsuited | Poor: thin layer, area reclaim. |
| [1]33: | | | | |
| Lambeth part | Fair: frost action, low strength. | Unsuited | Unsuited | Fair: slope. |
| Yawdim part | Poor: low strength, shrink-swell, thin layer. | Unsuited | Unsuited | Poor: too clayey, area reclaim, thin layer. |
| Lardell: | | | | |
| 34* | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: excess sodium, excess salt, area reclaim. |
| Lohler: | | | | |
| 35, 36 | Poor: shrink-swell, low strength. | Unsuited | Unsuited | Poor: thin layer, too clayey. |
| Lolo: | | | | |
| [1]37: | | | | |
| Lolo part | Fair: frost action. | Unsuited | Poor: excess fines. | Poor: small stones. |
| Lolo part | Fair: frost action. | Unsuited | Poor: excess fines. | Poor: small stones. |
| [1]38*: | | | | |
| Lolo part | Fair: frost action. | Unsuited | Poor: excess fines. | Poor: small stones. |
| Nesda part | Good | Poor: small stones. | Good | Poor: small stones. |
| Lonna: | | | | |
| 39 | Fair: shrink-swell, low strength, frost action. | Unsuited | Unsuited | Good. |
| 40 | Fair: shrink-swell, low strength, frost action. | Unsuited | Unsuited | Fair: slope. |
| McKenzie: | | | | |
| 41* | Poor: shrink-swell, wetness. | Unsuited | Unsuited | Poor: too clayey, excess salt. |
| Rentsac: | | | | |
| 42 | Poor: depth to rock, area reclaim. | Unsuited | Unsuited | Poor: slope, thin layer, area reclaim. |
| Rock outcrop: | | | | |
| [1]43*: | | | | |
| Rock outcrop part | --- | --- | --- | --- |
| Castner part | Poor: slope, thin layer, area reclaim. | Unsuited | Unsuited | Poor: slope, small stones, thin layer. |

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Rock outcrop--continued | | | | |
| 144*: | | | | |
| Rock outcrop part-- | --- | --- | --- | --- |
| Garlet part | Poor: slope. | Unsuited | Unsuited | Poor: small stones, slope. |
| 145*: | | | | |
| Rock outcrop part-- | --- | --- | --- | --- |
| Yawdim part | Poor: low strength, shrink-swell, slope. | Unsuited | Unsuited | Poor: too clayey, area reclaim, slope. |
| Sebud: | | | | |
| 46* | Fair: shrink-swell, frost action, low strength. | Unsuited | Unsuited | Poor: large stones. |
| 47* | Poor: slope. | Unsuited | Unsuited | Poor: slope, large stones. |
| 148*: | | | | |
| Sebud part | Poor: slope. | Unsuited | Unsuited | Poor: slope, large stones. |
| Cheadle part | Poor: slope, thin layer, area reclaim. | Unsuited | Unsuited | Poor: small stones, large stones, slope, thin layer. |
| Shane: | | | | |
| 49, 50 | Poor: shrink-swell, low strength, thin layer. | Unsuited | Unsuited | Poor: too clayey, thin layer. |
| 151: | | | | |
| Shane part | Poor: shrink-swell, low strength, thin layer. | Unsuited | Unsuited | Poor: too clayey, thin layer. |
| Cabba part | Fair: frost action, thin layer. | Unsuited | Unsuited | Fair: thin layer. |
| Shawa: | | | | |
| 52 | Fair: low strength, frost action. | Unsuited | Unsuited | Fair: too clayey. |
| Tanna: | | | | |
| 53 | Poor: low strength, thin layer. | Unsuited | Unsuited | Fair: too clayey, thin layer. |
| 54 | Poor: low strength, thin layer. | Unsuited | Unsuited | Fair: slope, too clayey, thin layer. |
| 155: | | | | |
| Tanna part | Poor: low strength, thin layer. | Unsuited | Unsuited | Fair: too clayey, thin layer. |

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Tanna--continued | | | | |
| Beenom part | Poor: thin layer, area reclaim. | Unsuited | Unsuited | Poor: thin layer, area reclaim. |
| [1]56: | | | | |
| Tanna part | Poor: low strength, thin layer. | Unsuited | Unsuited | Fair: slope, too clayey, thin layer. |
| Rentsac part | Poor: depth to rock, area reclaim. | Unsuited | Unsuited | Poor: thin layer, area reclaim. |
| Rentsac part | Poor: depth to rock, thin layer. | Unsuited | Unsuited: thin layer. | Poor: thin layer, area reclaim, small stones. |
| Torrifluvents: | | | | |
| [1]57*: | | | | |
| Torrifluvents part | --- | --- | --- | --- |
| Camborthids part | --- | --- | --- | --- |
| Turner: | | | | |
| 58, 59 | Good | Good | Good | Fair: thin layer, too clayey, small stones. |
| 60 | Good | Good | Good | Poor: large stones, small stones. |
| Ustifluvents: | | | | |
| [1]61*: | | | | |
| Ustifluvents part | --- | --- | --- | --- |
| Fluvaquents part | --- | --- | --- | --- |
| [1]62*: | | | | |
| Ustifluvents part | --- | --- | --- | --- |
| Ustochrepts part | --- | --- | --- | --- |
| Wayden: | | | | |
| [1]63*: | | | | |
| Wayden part | Poor: shrink-swell, low strength, slope. | Unsuited | Unsuited | Poor: slope. |
| Castner part | Poor: slope, thin layer, area reclaim. | Unsuited | Unsuited | Poor: slope, small stones, thin layer. |
| Winkler: | | | | |
| [1]64*: | | | | |
| Winkler part | Poor: slope. | Unsuited | Poor: excess fines. | Poor: small stones, slope. |
| Hilger part | Poor: slope. | Unsuited | Unsuited | Poor: slope, small stones, thin layer. |

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Winkler--continued | | | | |
| Rock outcrop part-- | --- | --- | --- | --- |
| Work: | | | | |
| 65 | Poor: shrink-swell, low strength. | Unsuited | Unsuited | Poor: thin layer. |
| 66 | Poor: shrink-swell, low strength. | Unsuited | Unsuited | Poor: slope, thin layer. |
| Yamac: | | | | |
| 67, 68, 69 | Fair: frost action, low strength. | Unsuited | Unsuited | Good. |
| 70 | Fair: frost action, low strength. | Unsuited | Unsuited | Fair: slope. |
| Yawdim: | | | | |
| [1]71*: | | | | |
| Yawdim part | Poor: low strength, shrink-swell, slope, thin layer. | Unsuited | Unsuited | Poor: too clayey, area reclaim, thin layer. |
| Lambeth part | Poor: slope. | Unsuited | Unsuited | Poor: slope. |
| Rock outcrop part-- | --- | --- | --- | --- |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 8.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Absarokee: | | | | | | |
| 1 | Slope, depth to rock. | Thin layer, low strength, shrink-swell. | Complex slope, percs slowly, depth to rock. | Complex slope, percs slowly, rooting depth. | Depth to rock, rooting depth, percs slowly. | Percs slowly, rooting depth, slope. |
| 2 | Slope, depth to rock. | Thin layer, low strength, shrink-swell. | Complex slope, percs slowly, depth to rock. | Complex slope, percs slowly, rooting depth. | Complex slope, depth to rock, percs slowly. | Percs slowly, rooting depth, slope. |
| 3: | | | | | | |
| Absarokee part- | Slope, depth to rock. | Thin layer, low strength, shrink-swell. | Complex slope, percs slowly, depth to rock. | Complex slope, percs slowly, rooting depth. | Depth to rock, rooting depth, percs slowly. | Percs slowly, rooting depth, slope. |
| Sinnigam part-- | Slope, depth to rock. | Thin layer, shrink-swell. | Slope, depth to rock. | Slope, rooting depth. | Depth to rock, small stones. | Slope, rooting depth. |
| 4: | | | | | | |
| Absarokee part- | Slope, depth to rock. | Thin layer, low strength, shrink-swell. | Complex slope, percs slowly, depth to rock. | Complex slope, percs slowly, rooting depth. | Complex slope, depth to rock, percs slowly. | Percs slowly, rooting depth, slope. |
| Sinnigam part-- | Slope, depth to rock. | Thin layer, shrink-swell. | Slope, depth to rock. | Slope, rooting depth. | Slope, depth to rock, small stones. | Slope, rooting depth. |
| 5*: | | | | | | |
| Absarokee part- | Slope, depth to rock. | Thin layer, low strength, shrink-swell. | Complex slope, percs slowly, depth to rock. | Complex slope, percs slowly, rooting depth. | Complex slope, depth to rock, percs slowly. | Percs slowly, rooting depth, slope. |
| Sinnigam part-- | Slope, depth to rock. | Thin layer, shrink-swell. | Slope, depth to rock. | Slope, rooting depth. | Slope, depth to rock, small stones. | Slope, rooting depth. |
| 6: | | | | | | |
| Absarokee part- | Slope, depth to rock. | Thin layer, low strength, shrink-swell. | Complex slope, percs slowly, depth to rock. | Complex slope, percs slowly, rooting depth. | Depth to rock, rooting depth, percs slowly. | Percs slowly, rooting depth, slope. |
| Amherst part--- | Slope, depth to rock. | Thin layer, low strength, piping. | Slope, depth to rock. | Slope, rooting depth. | Depth to rock, piping, rooting depth. | Slope, rooting depth. |
| Castner part--- | Slope, depth to rock. | Piping, thin layer. | Slope, depth to rock. | Rooting depth, droughty, slope. | Depth to rock, piping, rooting depth. | Rooting depth, slope. |
| Absher: | | | | | | |
| 7 | Favorable------ | Low strength, shrink-swell, hard to pack. | Slope, excess sodium, excess salt. | Slope, excess sodium, excess salt. | Percs slowly, poor outlets. | Excess salt, excess sodium. |
| Amherst: | | | | | | |
| 8: | | | | | | |
| Amherst part--- | Slope, depth to rock. | Thin layer, low strength, piping. | Slope, depth to rock. | Slope, rooting depth. | Slope, depth to rock, piping. | Slope, rooting depth. |
| Absarokee part- | Slope, depth to rock. | Thin layer, low strength, shrink-swell. | Complex slope, percs slowly, depth to rock. | Complex slope, percs slowly, rooting depth. | Complex slope, depth to rock, percs slowly. | Percs slowly, rooting depth, slope. |
| Castner part--- | Slope, depth to rock. | Piping, thin layer. | Slope, depth to rock. | Rooting depth, droughty, slope. | Slope, depth to rock, rooting depth. | Rooting depth, slope. |

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Assinniboine: | | | | | | |
| 9 | Slope, seepage. | Piping, low strength. | Slope | Slope, fast intake, seepage. | Slope, piping, soil blowing. | Slope. |
| [1]10: | | | | | | |
| Assinniboine part | Slope, seepage. | Piping, low strength. | Slope | Slope, fast intake, seepage. | Slope, piping, soil blowing. | Slope. |
| Rentsac part | Slope, depth to rock, seepage. | Thin layer | Slope, depth to rock. | --- | Slope, depth to rock, rooting depth. | Rooting depth, slope. |
| Attewan: | | | | | | |
| 11 | Seepage | Seepage, piping. | Slope, cutbanks cave. | Slope, seepage, droughty. | Small stones, piping. | Droughty. |
| 12 | Seepage | Seepage, piping. | Slope, cutbanks cave, frost action. | Slope | Wetness, small stones, piping. | Wetness. |
| [1]13: | | | | | | |
| Attewan part | Seepage | Seepage, piping. | Slope, cutbanks cave. | Slope | Small stones, piping. | Droughty. |
| Beaverell part | Seepage | Seepage, piping. | Slope, cutbanks cave. | Slope, droughty, seepage. | Piping | Droughty. |
| Beaverell: | | | | | | |
| 14 | Slope, seepage. | Seepage, piping. | Slope, cutbanks cave. | Slope, droughty, seepage. | Piping | Slope, droughty. |
| Birney: | | | | | | |
| [1]15*: | | | | | | |
| Birney part | Slope, seepage. | Seepage, piping. | Slope | Slope, droughty. | Slope, piping. | Slope, droughty. |
| Yawdim part | Slope, depth to rock. | Shrink-swell, compressible. | Depth to rock, slope. | Droughty, percs slowly, rooting depth. | Percs slowly, depth to rock, slope. | Droughty, percs slowly, rooting depth. |
| Rock outcrop part | --- | --- | --- | --- | --- | --- |
| Bonfri: | | | | | | |
| [1]16: | | | | | | |
| Bonfri part | Slope | Low strength, piping, thin layer. | Slope, depth to rock, percs slowly. | Slope, percs slowly, rooting depth. | Percs slowly, piping, depth to rock. | Slope, percs slowly, rooting depth. |
| Lambeth part | Slope | Piping, hard to pack, low strength. | Slope, percs slowly. | Slope, percs slowly. | Erodes easily, percs slowly, piping. | Slope, erodes easily, percs slowly. |
| [1]17: | | | | | | |
| Bonfri part | Slope | Low strength, piping, thin layer. | Slope, depth to rock, percs slowly. | Slope, percs slowly, rooting depth. | Slope | Slope, percs slowly, rooting depth. |
| Lambeth part | Slope | Piping, hard to pack, low strength. | Slope, percs slowly. | Slope, percs slowly. | Slope, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |
| Garlet: | | | | | | |
| [1]18*: | | | | | | |
| Garlet part | Slope | Piping | --- | --- | Piping, slope. | Slope. |

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Garlet--continued | | | | | | |
| Sebud part | Slope | Large stones, low strength. | --- | --- | Large stones, slope. | Large stones, slope. |
| Glendive: | | | | | | |
| 19 | Seepage | Piping, low strength. | Floods | Erodes easily, seepage. | Erodes easily, piping. | Erodes easily. |
| 20 | Seepage | Piping, low strength. | Floods | Seepage, floods. | Piping | Erodes easily. |
| Grail: | | | | | | |
| 21, 22 | Favorable | Compressible, low strength, piping. | Not needed | Slow intake | Piping | Favorable. |
| Harlem: | | | | | | |
| 23 | Favorable | Low strength, shrink-swell. | Percs slowly | Percs slowly, slow intake. | Percs slowly, poor outlets. | Percs slowly. |
| 24 | Favorable | Low strength, shrink-swell. | Percs slowly | Percs slowly, slow intake, floods. | Percs slowly, poor outlets. | Percs slowly. |
| Havre: | | | | | | |
| 25 | Favorable | Low strength, piping. | Favorable | Favorable | Piping | Favorable. |
| 26 | Favorable | Low strength, piping. | Slope | Slope, erodes easily. | Piping | Erodes easily. |
| 27 | Favorable | Low strength, piping. | Floods | Floods | Piping | Favorable. |
| Hilger: | | | | | | |
| [1]28*: | | | | | | |
| Hilger part | Slope | Shrink-swell, piping. | --- | --- | Slope, piping. | Slope, droughty. |
| Castner part | Slope, seepage, depth to rock. | Large stones, thin layer, piping. | --- | --- | Slope, depth to rock, large stones. | Rooting depth, large stones, slope. |
| Rock outcrop part | --- | --- | --- | --- | --- | --- |
| Kobar: | | | | | | |
| 29 | Favorable | Shrink-swell, low strength, compressible. | Slope, percs slowly. | Slope, percs slowly, slow intake. | Percs slowly | Percs slowly. |
| 30 | Slope | Shrink-swell, low strength, compressible. | Slope, percs slowly. | Slope, percs slowly, slow intake. | Percs slowly | Slope, percs slowly. |
| Lambeth: | | | | | | |
| 31 | Slope | Piping, hard to pack, low strength. | Slope, percs slowly. | Slope, percs slowly. | Slope, piping, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |
| [1]32: | | | | | | |
| Lambeth part | Slope | Piping, hard to pack, low strength. | Slope, percs slowly. | Slope, percs slowly. | Slope, piping, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |
| Rentsac part | Slope, depth to rock, seepage. | Piping, thin layer. | Slope, depth to rock. | --- | Slope, rooting depth, depth to rock. | Slope, rooting depth. |

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Lambeth--continued | | | | | | |
| [1]33: | | | | | | |
| Lambeth part--- | Slope---------- | Piping, hard to pack, low strength. | Slope, percs slowly. | Slope, percs slowly. | Slope, piping, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |
| Yawdim part---- | Slope, depth to rock. | Shrink-swell, compressible. | Not needed----- | Droughty, percs slowly, rooting depth. | Percs slowly, depth to rock, slope. | Droughty, percs slowly, rooting depth. |
| Lardell: | | | | | | |
| 34*---------- | Favorable------ | Shrink-swell, low strength, hard to pack. | Percs slowly, excess sodium, excess salt. | --- | Wetness, percs slowly, poor outlets. | Excess salt, wetness, percs slowly. |
| Lohler: | | | | | | |
| 35, 36---------- | Favorable------ | Compressible, hard to pack, shrink-swell. | Poor outlets--- | Slow intake---- | Percs slowly--- | Not needed. |
| Lolo: | | | | | | |
| [1]37: | | | | | | |
| Lolo part------ | Seepage-------- | Piping--------- | Slope---------- | Slope, fast intake, seepage. | Small stones, piping. | Favorable. |
| Lolo part------ | Seepage-------- | Piping--------- | Slope---------- | Slope, fast intake, seepage. | Small stones, piping. | Favorable. |
| [1]38*: | | | | | | |
| Lolo part------ | Seepage-------- | Seepage, piping, hard to pack. | Wetness, floods. | Floods, wetness, seepage. | Piping, small stones, poor outlets. | Wetness. |
| Nesda part----- | Seepage-------- | Seepage, piping. | Floods, cutbanks cave. | Floods, droughty. | Small stones--- | Droughty. |
| Lonna: | | | | | | |
| 39---------- | Slope---------- | Low strength, piping, hard to pack. | Slope---------- | Slope, erodes easily. | Piping, erodes easily. | Slope, erodes easily. |
| 40---------- | Slope---------- | Low strength, piping, hard to pack. | Slope---------- | Slope, erodes easily. | Slope, piping, erodes easily. | Slope, erodes easily. |
| McKenzie: | | | | | | |
| 41*---------- | Favorable------ | Shrink-swell, hard to pack, low strength. | --- | --- | Poor outlets, percs slowly, wetness. | --- |
| Rentsac: | | | | | | |
| 42---------- | Slope, depth to rock, seepage. | Thin layer----- | Slope, depth to rock. | --- | Slope, depth to rock. | Slope, rooting depth. |
| Rock outcrop: | | | | | | |
| [1]43*: | | | | | | |
| Rock outcrop part---------- | --- | --- | --- | --- | --- | --- |
| Castner part--- | Slope, depth to rock. | Piping, thin layer. | Slope, depth to rock. | Rooting depth, droughty, slope. | Slope, depth to rock, rooting depth. | Rooting depth, slope. |
| [1]44*: | | | | | | |
| Rock outcrop part---------- | --- | --- | --- | --- | --- | --- |
| Garlet part---- | Slope---------- | Piping--------- | --- | --- | Piping, slope. | Slope. |

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Rock outcrop--continued | | | | | | |
| [1]45*: | | | | | | |
| Rock outcrop part | --- | --- | --- | --- | --- | --- |
| Yawdim part | Slope, depth to rock. | Shrink-swell, compressible. | Not needed | Droughty, percs slowly, rooting depth. | Percs slowly, depth to rock, slope. | Droughty, percs slowly, rooting depth. |
| Sebud: | | | | | | |
| 46*, 47* | Slope | Large stones, low strength. | --- | --- | Slope, large stones. | Slope, large stones. |
| [1]48*: | | | | | | |
| Sebud part | Slope | Large stones, low strength. | --- | --- | Slope, large stones. | Slope, large stones. |
| Cheadle part | Slope, seepage, depth to rock. | Thin layer, large stones, piping. | --- | --- | Slope, depth to rock, rooting depth. | Slope, rooting depth, large stones. |
| Shane: | | | | | | |
| 49 | Slope, depth to rock. | Low strength, shrink-swell, hard to pack. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. | Percs slowly, depth to rock, rooting depth. | Slope, percs slowly, rooting depth. |
| 50 | Slope, depth to rock. | Low strength, shrink-swell, hard to pack. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. |
| [1]51: | | | | | | |
| Shane part | Slope, depth to rock. | Low strength, shrink-swell, hard to pack. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. | Percs slowly, depth to rock, rooting depth. | Slope, percs slowly, rooting depth. |
| Cabba part | Slope, seepage, depth to rock. | Thin layer, piping, low strength. | Not needed | | Depth to rock, slope, rooting depth. | Rooting depth, slope, droughty. |
| Shawa: | | | | | | |
| 52 | Slope | Low strength, piping. | Slope, poor outlets. | Slope | Piping | Favorable. |
| Tanna: | | | | | | |
| 53 | Slope, seepage, depth to rock. | Low strength, shrink-swell, compressible. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. | Percs slowly, depth to rock, rooting depth. | Slope, percs slowly, rooting depth. |
| 54 | Slope, seepage, depth to rock. | Low strength, shrink-swell, compressible. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. |
| [1]55: | | | | | | |
| Tanna part | Slope, seepage, depth to rock. | Low strength, shrink-swell, compressible. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. | Percs slowly, depth to rock, rooting depth. | Slope, percs slowly, rooting depth. |
| Beenom part | Slope, seepage, depth to rock. | Thin layer, low strength, piping. | Slope, depth to rock, frost action. | Slope, rooting depth, droughty. | Depth to rock, piping, rooting depth. | Slope, droughty, rooting depth. |
| [1]56: | | | | | | |
| Tanna part | Slope, seepage, depth to rock. | Low strength, shrink-swell, compressible. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. | Slope, percs slowly, depth to rock. | Slope, percs slowly, rooting depth. |
| Rentsac part | Slope, seepage, depth to rock. | Piping, thin layer. | --- | --- | Slope, rooting depth, depth to rock. | Slope, rooting depth. |
| Rentsac part | Slope, seepage, depth to rock. | Thin layer, piping. | --- | --- | Slope, depth to rock, rooting depth. | Rooting depth, slope. |

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Torrifluvents: | | | | | | |
| [1]57*: | | | | | | |
| Torrifluvents part | --- | --- | --- | --- | --- | --- |
| Camborthids part | --- | --- | --- | --- | --- | --- |
| Turner: | | | | | | |
| 58 | Seepage | Piping, seepage. | Slope, cutbanks cave. | Slope, seepage, droughty. | Too sandy | Droughty. |
| 59 | Slope, seepage. | Piping, seepage. | Slope, cutbanks cave. | Slope, seepage, droughty. | Too sandy | Slope, droughty. |
| 60 | Seepage, slope. | Seepage, large stones. piping | Slope, cutbanks cave. | Seepage, droughty, slope. | Slope, large stone. | Large stones, slope, droughty. |
| Ustifluvents: | | | | | | |
| [1]61*: | | | | | | |
| Ustifluvents part | --- | --- | Floods | Floods | --- | --- |
| Fluvaquents part. | | | | | | |
| [1]62*: | | | | | | |
| Ustifluvents part | --- | --- | Floods | Floods | --- | --- |
| Ustochrepts part. | | | | | | |
| Wayden: | | | | | | |
| [1]63*: | | | | | | |
| Wayden part | Depth to rock, seepage. | Thin layer, shrink-swell, low strength. | Slope, depth to rock. | Percs slowly, slow intake, rooting depth. | Depth to rock, erodes easily, rooting depth. | Droughty, erodes easily, percs slowly. |
| Castner part | Slope, seepage, depth to rock. | Piping, thin layer. | Slope, depth to rock. | Rooting depth, droughty, slope. | Slope, depth to rock, rooting depth. | Rooting depth, slope. |
| Winkler: | | | | | | |
| [1]64*: | | | | | | |
| Winkler part | Slope, seepage. | Seepage, piping. | --- | --- | Slope, piping. | --- |
| Hilger part | Slope | Shrink-swell, piping. | --- | --- | Slope, large stones, piping. | --- |
| Rock outcrop part | --- | --- | --- | --- | --- | --- |
| Work: | | | | | | |
| 65 | Slope | Shrink-swell, low strength, hard to pack. | Slope, percs slowly. | Slope, percs slowly. | Percs slowly | Slope, percs slowly. |
| 66 | Slope | Shrink-swell, low strength, hard to pack. | Slope, percs slowly. | Slope, percs slowly. | Slope, percs slowly. | Slope, percs slowly. |
| Yamac: | | | | | | |
| 67 | Favorable | Piping, low strength, hard to pack. | Favorable | Favorable | Piping | Favorable. |

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Yamac--continued | | | | | | |
| 68 | Favorable | Piping, low strength, hard to pack. | Slope | Slope | Piping | Favorable. |
| 69 | Slope | Piping, low strength, hard to pack. | Slope | Slope | Piping | Slope. |
| 70 | Slope | Piping, low strength, hard to pack. | Slope | Slope | Slope, piping. | Slope. |
| Yawdim: [1] 71*: | | | | | | |
| Yawdim part | Slope, depth to rock. | Shrink-swell, compressible. | Slope, depth to rock. | Droughty, percs slowly, rooting depth. | Percs slowly, depth to rock, slope. | Droughty, percs slowly, rooting depth. |
| Lambeth part | Slope | Piping, hard to pack, low strength. | Slope, percs slowly. | Slope, percs slowly. | Slope, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |
| Rock outcrop part | --- | --- | --- | --- | --- | --- |

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol > means more than. NP means nonplastic. Absence of an entry indicates that data were not estimated]

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | > 3 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Absarokee: | | | | | | | | | | | |
| 1, 2 | 0-6 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 90-100 | 70-80 | 25-35 | 10-15 |
| | 6-35 | Clay, clay loam | CL, CH | A-7 | 0-5 | 95-100 | 95-100 | 90-100 | 75-95 | 45-60 | 20-35 |
| | 35 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]3: | | | | | | | | | | | |
| Absarokee part | 0-6 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 90-100 | 70-80 | 25-35 | 10-15 |
| | 6-35 | Clay, clay loam | CL, CH | A-7 | 0-5 | 95-100 | 90-100 | 90-100 | 75-95 | 45-60 | 20-35 |
| | 35 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sinnigam part | 0-5 | Clay loam | CL | A-6 | 0-5 | 90-100 | 85-100 | 90-100 | 70-80 | 30-40 | 10-15 |
| | 5-18 | Very channery loam. | GC, CL | A-6 | 25-40 | 45-75 | 35-65 | 30-60 | 30-80 | 30-40 | 10-20 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]4: | | | | | | | | | | | |
| Absarokee part | 0-6 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 90-100 | 70-80 | 25-35 | 10-15 |
| | 6-35 | Clay, clay loam | CL, CH | A-7 | 0-5 | 95-100 | 90-100 | 90-100 | 75-95 | 45-60 | 20-35 |
| | 35 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sinnigam part | 0-5 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 90-100 | 70-80 | 30-40 | 10-15 |
| | 5-18 | Very channery clay. | GC, CL | A-6 | 25-40 | 45-75 | 35-65 | 30-60 | 30-55 | 30-40 | 10-20 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]5*: | | | | | | | | | | | |
| Absarokee part | 0-6 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 90-100 | 70-80 | 25-35 | 10-15 |
| | 6-24 | Clay, clay loam | CL, CH | A-7 | 0-5 | 95-100 | 90-100 | 90-100 | 75-95 | 45-60 | 20-35 |
| | 24 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sinnigam part | 0-5 | Channery clay loam. | GC | A-2, A-6 | 0-10 | 55-65 | 50-55 | 45-55 | 30-40 | 25-35 | 10-15 |
| | 5-18 | Very channery clay. | GC, CL | A-6 | 25-40 | 45-75 | 35-65 | 30-60 | 30-55 | 30-40 | 10-20 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]6: | | | | | | | | | | | |
| Absarokee part | 0-6 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 90-100 | 70-80 | 25-35 | 10-15 |
| | 6-24 | Clay, clay loam | CL, CH | A-7 | 0-5 | 95-100 | 90-100 | 90-100 | 75-95 | 45-60 | 20-35 |
| | 24 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Amherst part | 0-4 | Loam | ML, CL-ML | A-4 | 0-5 | 90-100 | 90-100 | 85-95 | 60-75 | 25-35 | 5-10 |
| | 4-18 | Channery clay loam, clay loam | CL, GC | A-6, A-7 | 0-5 | 65-85 | 55-75 | 50-70 | 40-65 | 35-45 | 15-20 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Castner part | 0-10 | Loam | ML, CL-ML | A-4 | 0-5 | 95-100 | 95-100 | 80-90 | 60-75 | 25-35 | 5-10 |
| | 10-18 | Very channery loam. | GM | A-2, A-4, A-1 | 15-25 | 50-60 | 40-50 | 35-45 | 20-40 | 25-35 | NP-10 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | > 3 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Absher: | | | | | | | | | | | |
| 7 | 0-5 | Silty clay loam | CL | A-6, A-7 | 0 | 100 | 100 | 90-100 | 75-95 | 35-45 | 15-25 |
| | 5-60 | Clay loam, clay | CL, CH | A-7 | 0 | 100 | 100 | 90-100 | 75-95 | 40-60 | 20-40 |
| Amherst: | | | | | | | | | | | |
| [1]8: | | | | | | | | | | | |
| Amherst part | 0-4 | Loam | ML, CL-ML | A-4 | 0-5 | 90-100 | 90-100 | 85-95 | 60-75 | 25-35 | 5-10 |
| | 4-18 | Channery clay loam, clay loam | CL, GC | A-6, A-7 | 0-5 | 65-85 | 55-75 | 50-70 | 40-65 | 35-45 | 15-20 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Absarokee part | 0-6 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 90-100 | 70-80 | 25-35 | 10-15 |
| | 6-24 | Clay, clay loam | CL, CH | A-7 | 0-5 | 95-100 | 90-100 | 90-100 | 75-95 | 45-60 | 20-35 |
| | 24 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Castner part | 0-10 | Loam | ML, CL-ML | A-4 | 0-5 | 95-100 | 95-100 | 80-90 | 60-75 | 25-35 | 5-10 |
| | 10-18 | Very channery loam. | GM | A-2, A-4, A-1 | 15-25 | 50-60 | 40-50 | 35-45 | 20-40 | 25-35 | NP-10 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assinniboine: | | | | | | | | | | | |
| 9 | 0-6 | Fine sandy loam | SM, ML | A-4 | 0 | 100 | 100 | 70-85 | 40-55 | 20-30 | NP-5 |
| | 6-20 | Sandy clay loam | SC, CL | A-6 | 0 | 100 | 100 | 80-90 | 35-55 | 25-35 | 10-15 |
| | 20-60 | Fine sandy loam | SM, ML | A-4 | 0 | 100 | 100 | 70-85 | 40-55 | 20-30 | NP-5 |
| [1]10: | | | | | | | | | | | |
| Assinniboine part | 0-6 | Fine sandy loam | SM, ML | A-4 | 0 | 100 | 100 | 70-85 | 40-55 | 20-30 | NP-5 |
| | 6-20 | Sandy clay loam | SC, CL | A-6 | 0 | 100 | 100 | 80-90 | 35-55 | 25-35 | 10-15 |
| | 20-60 | Fine sandy loam | SM, ML | A-4 | 0 | 100 | 100 | 70-85 | 40-55 | 20-30 | NP-5 |
| Rentsac part | 0-8 | Channery loam | GM, ML | A-2, A-4 | 5-10 | 50-80 | 35-75 | 30-65 | 25-55 | 20-35 | NP-10 |
| | 8-18 | Very channery loam. | GM | A-1, A-2 | 5-10 | 30-60 | 20-50 | 15-45 | 10-35 | --- | NP |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Attewan: | | | | | | | | | | | |
| 11, 12 | 0-9 | Loam | CL-ML, CL | A-4, A-6 | 0-5 | 85-100 | 85-100 | 80-95 | 60-75 | 25-35 | 5-15 |
| | 9-18 | Clay loam, gravelly clay loam. | CL, GM | A-6 | 0-5 | 60-100 | 50-100 | 45-95 | 35-80 | 30-40 | 10-15 |
| | 18-28 | Loam, gravelly loam. | ML, GM | A-4 | 0-10 | 60-100 | 50-100 | 45-95 | 35-75 | 25-35 | NP-10 |
| | 28-60 | Very gravelly sand, very gravelly loamy sand. | GP, GP-GM | A-1 | 0-25 | 35-45 | 25-30 | 15-20 | 0-10 | --- | NP |
| [1]13: | | | | | | | | | | | |
| Attewan part | 0-9 | Gravelly loam | ML,GM | A-4 | 0-5 | 60-85 | 50-75 | 45-70 | 35-55 | 25-35 | NP-10 |
| | 9-18 | Clay loam, gravelly clay loam. | CL,GM | A-6 | 0-5 | 60-100 | 50-100 | 45-95 | 35-80 | 30-40 | 10-15 |
| | 18-28 | Loam, gravelly loam. | ML, SM | A-4 | 0-10 | 60-100 | 50-100 | 45-95 | 35-75 | 25-35 | NP-10 |
| | 28-60 | Very gravelly sand, very gravelly loamy sand. | GP, GP-GM | A-1 | 0-25 | 35-45 | 25-30 | 15-20 | 0-10 | --- | NP |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Attewan--continued | | | | | | | | | | | |
| [1]13: | | | | | | | | | | | |
| Beaverell part-- | 0-6 | Gravelly loam--- | GM, GM-GC | A-2, A-4 | 0-15 | 55-75 | 50-65 | 40-60 | 25-50 | 20-30 | NP-10 |
| | 6-12 | Very gravelly loam. | GM-GC, GC | A-2 | 0-15 | 35-45 | 25-35 | 20-30 | 15-25 | 25-35 | 5-15 |
| | 12-60 | Stratified very gravelly sand to loamy sand. | GM, SM | A-1, A-2 | 0-15 | 30-95 | 20-85 | 15-65 | 5-25 | --- | NP |
| Beaverell: | | | | | | | | | | | |
| [1]4---------- | 0-6 | Very gravelly loam. | GM, GM-GC | A-2, A-1 | 0-15 | 35-45 | 25-35 | 20-30 | 15-25 | 20-30 | NP-10 |
| | 6-12 | Very gravelly loam. | GM-GC, GC | A-2 | 0-15 | 35-45 | 25-35 | 20-30 | 15-25 | 25-35 | 5-15 |
| | 12-60 | Stratified very gravelly sand to loamy sand. | GM, SM | A-1, A-2 | 0-15 | 30-95 | 20-85 | 15-65 | 5-25 | --- | NP |
| Birney: | | | | | | | | | | | |
| [1]15*: | | | | | | | | | | | |
| Birney part----- | 0-4 | Channery loam--- | SM, ML | A-4 | 0 | 75-85 | 60-75 | 50-70 | 35-55 | 25-35 | NP-10 |
| | 4-14 | Channery loam, very channery loam. | SM, GM | A-1, A-2 | 0 | 25-55 | 15-45 | 15-40 | 10-35 | 25-35 | NP-10 |
| | 14-60 | Very channery sandy loam, channery sandy loam. | GM, SM, GP-GM | A-1, A-2 | 0-20 | 35-60 | 20-50 | 10-35 | 5-20 | 25-35 | NP-10 |
| Yawdim part----- | 0-15 | Clay loam------- | CL, CH | A-7 | 0 | 100 | 100 | 90-100 | 70-95 | 40-75 | 25-50 |
| | 15 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rock outcrop part. | | | | | | | | | | | |
| Bonfri: | | | | | | | | | | | |
| [1]16: | | | | | | | | | | | |
| Bonfri part----- | 0-7 | Loam---------- | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 85-95 | 60-75 | 25-35 | 5-15 |
| | 7-23 | Clay loam------- | CL | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 30-40 | 10-20 |
| | 23-36 | Clay loam------- | CL | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 30-40 | 10-20 |
| | 36 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lambeth part---- | 0-8 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| | 8-60 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| [1]17: | | | | | | | | | | | |
| Bonfri part----- | 0-7 | Loam---------- | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 85-95 | 60-75 | 25-35 | 5-15 |
| | 7-23 | Clay loam------- | CL | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 30-40 | 10-20 |
| | 23-36 | Clay loam------- | CL | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 30-40 | 10-20 |
| | 36 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lambeth part---- | 0-8 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| | 8-60 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| Garlet: | | | | | | | | | | | |
| [1]18*: | | | | | | | | | | | |
| Garlet part----- | 0-12 | Gravelly sandy loam. | SM, GM | A-1 | 0-10 | 55-70 | 50-60 | 30-40 | 15-25 | 20-30 | NP-5 |
| | 12-53 | Gravelly sandy loam. | SM, GM | A-2 | 0-15 | 55-80 | 50-75 | 25-60 | 15-35 | 30-40 | 5-10 |
| | 53-60 | Very cobbly loam | ML, GM, CL-ML, GM-GC | A-2, A-4 | 65-75 | 55-80 | 45-70 | 40-65 | 25-55 | 25-35 | 5-10 |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Garlet--continued | | | | | | | | | | | |
| [1]18*: | | | | | | | | | | | |
| Sebud part------ | 0-4 | Stony loam------ | ML, SM | A-4 | 25-40 | 75-95 | 60-85 | 50-80 | 35-65 | 25-35 | NP-10 |
| | 4-10 | Very stony loam | ML, SM | A-4 | 25-40 | 75-95 | 60-85 | 50-80 | 35-55 | 25-35 | NP-10 |
| | 10-24 | Very stony clay loam. | CL, SC | A-6 | 25-40 | 75-95 | 60-85 | 50-85 | 40-70 | 30-40 | 10-15 |
| | 24-60 | Very stony sandy clay loam. | SC, SM-SC | A-2, A-4, A-6 | 25-40 | 75-95 | 60-85 | 45-75 | 20-45 | 25-35 | 5-15 |
| Glendive: | | | | | | | | | | | |
| 19, 20---------- | 0-6 | Fine sandy loam | ML, SM | A-4 | 0 | 100 | 100 | 70-85 | 40-55 | 20-35 | NP-5 |
| | 6-60 | Stratified sandy loams. | SM | A-4, A-2 | 0 | 95-100 | 75-100 | 60-80 | 30-45 | 15-30 | NP-5 |
| Grail: | | | | | | | | | | | |
| 21, 22---------- | 0-13 | Clay loam------- | CL, CL-ML | A-4, A-6, A-7 | 0 | 90-100 | 75-95 | 70-90 | 65-80 | 20-45 | 5-25 |
| | 13-24 | Clay loam------- | CL | A-7, A-6 | 0 | 90-100 | 75-95 | 75-95 | 75-85 | 35-45 | 15-30 |
| | 24-60 | Silty clay loam | ML, CL | A-6, A-7 | 0 | 90-100 | 75-95 | 75-95 | 75-90 | 35-45 | 10-30 |
| Harlem: | | | | | | | | | | | |
| 23, 24---------- | 0-9 | Clay loam------- | CL | A-6, A-7 | 0 | 100 | 100 | 90-100 | 70-80 | 35-45 | 15-20 |
| | 9-60 | Stratified clay to loam. | CL, CH | A-7 | 0 | 100 | 100 | 95-100 | 85-95 | 40-55 | 20-40 |
| Havre: | | | | | | | | | | | |
| 25, 26, 27-------- | 0-6 | Loam---------- | ML, CL-ML | A-4 | 0 | 100 | 100 | 80-95 | 60-75 | 20-30 | NP-10 |
| | 6-60 | Loam---------- | ML | A-4 | 0 | 100 | 100 | 80-95 | 60-75 | 15-25 | NP-5 |
| Hilger: | | | | | | | | | | | |
| [1]28*: | | | | | | | | | | | |
| Hilger part----- | 0-4 | Cobbly sandy loam. | SM | A-1, A-2 | 30-50 | 70-90 | 60-90 | 35-65 | 20-35 | --- | NP |
| | 4-24 | Very cobbly sandy clay loam, very cobbly clay loam, very cobbly loam. | SC, SM-SC, CL, CL-ML | A-2, A-4, A-6 | 50-60 | 70-85 | 60-75 | 50-70 | 30-60 | 25-35 | 5-15 |
| | 24-60 | Very cobbly loam | GM, SM | A-1, A-2, A-4 | 65-90 | 45-80 | 35-70 | 30-65 | 20-50 | 25-35 | NP-10 |
| Castner part---- | 0-10 | Stony loam------ | SM, ML | A-4 | 15-40 | 75-90 | 65-90 | 55-85 | 40-70 | 25-35 | NP-10 |
| | 10-18 | Very channery loam. | GM | A-2, A-4, A-1 | 15-25 | 50-60 | 40-50 | 35-45 | 20-40 | 25-35 | NP-10 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rock outcrop part. | | | | | | | | | | | |
| Kobar: | | | | | | | | | | | |
| 29, 30---------- | 0-5 | Clay loam------- | CL | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 30-40 | 15-20 |
| | 5-60 | Silty clay loam, silty clay, clay. | CL, CH | A-7 | 0 | 100 | 100 | 95-100 | 85-95 | 40-55 | 20-30 |
| Lambeth: | | | | | | | | | | | |
| 31---------- | 0-8 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| | 8-60 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | > 3 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Lambeth--continued | | | | | | | | | | | |
| [1]32: | | | | | | | | | | | |
| Lambeth part---- | 0-8 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| | 8-60 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| Rentsac part---- | 0-8 | Loam------------ | ML, CL-ML | A-4 | 0-5 | 95-100 | 80-100 | 65-95 | 50-75 | 25-35 | 5-10 |
| | 8-18 | Very channery loam. | GM | A-1, A-2 | 5-10 | 30-60 | 20-50 | 15-45 | 10-35 | 15-25 | NP-5 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]33: | | | | | | | | | | | |
| Lambeth part---- | 0-8 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| | 8-60 | Silt loam------- | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| Yawdim part----- | 0-10 | Clay loam------- | CL, CH | A-7 | 0 | 100 | 100 | 90-100 | 70-95 | 40-75 | 25-50 |
| | 10 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lardell: | | | | | | | | | | | |
| 34*--------------- | 0-7 | Clay loam------- | ML, CL | A-4, A-6, A-7 | 0 | 100 | 100 | 85-100 | 75-85 | 35-45 | 5-15 |
| | 7-60 | Stratified clay loam to silty clay loam. | CL-ML, CL | A-4, A-6, A-7 | 0 | 100 | 100 | 80-90 | 65-85 | 25-45 | 5-20 |
| Lohler: | | | | | | | | | | | |
| 35, 36------------ | 0-9 | Clay loam------- | CL, ML | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 35-40 | 10-20 |
| | 9-60 | Clay------------ | CH, CL | A-7 | 0 | 100 | 100 | 95-100 | 80-95 | 45-70 | 25-50 |
| Lolo: | | | | | | | | | | | |
| [1]37: | | | | | | | | | | | |
| Lolo part------- | 0-13 | Very gravelly loam. | GM | A-1 | 0-10 | 30-45 | 20-35 | 20-30 | 15-25 | --- | NP |
| | 13-24 | Very gravelly loam. | GM | A-1 | 0-10 | 30-45 | 30-35 | 25-30 | 20-25 | --- | NP |
| | 24-60 | Very gravelly fine sandy loam | GM, GP-GM | A-1 | 0-10 | 30-45 | 20-35 | 15-30 | 5-15 | --- | NP |
| Lolo part------- | 0-13 | Cobbly loam----- | SM, ML | A-4 | 20-30 | 75-90 | 65-90 | 55-90 | 40-70 | --- | NP |
| | 13-24 | Gravelly loam--- | GM | A-2, A-4 | 0-10 | 55-70 | 50-60 | 40-55 | 25-45 | --- | NP |
| | 24-60 | Very gravelly fine sandy loam | GM | A-1 | 0-10 | 30-45 | 20-35 | 15-30 | 5-15 | --- | NP |
| [1]38*: | | | | | | | | | | | |
| Lolo part------- | 0-13 | Very gravelly loam. | GM | A-1 | 0-10 | 30-45 | 20-35 | 20-30 | 15-25 | --- | NP |
| | 13-24 | Very gravelly loam. | GM | A-1 | 0-10 | 30-45 | 20-35 | 25-30 | 20-25 | --- | NP |
| | 24-60 | Very gravelly fine sandy loam | GM, GP-GM | A-1 | 0-10 | 30-45 | 20-35 | 15-30 | 5-15 | --- | NP |
| Nesda part------ | 0-16 | Gravelly loam--- | ML, GM | A-2, A-4 | 0-5 | 55-80 | 50-70 | 40-65 | 25-55 | --- | NP |
| | 16-60 | Very cobbly sand. | SP, SP-SM | A-1, A-2 | 30-60 | 60-75 | 50-70 | 25-50 | 0-10 | --- | NP |
| Lonna: | | | | | | | | | | | |
| 39, 40------------ | 0-2 | Silt loam------- | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 85-100 | 70-90 | 25-40 | 5-15 |
| | 2-28 | Silt loam------- | CL | A-6 | 0 | 100 | 100 | 90-100 | 85-95 | 30-40 | 10-20 |
| | 28-60 | Stratified loam to silty clay loam. | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 80-95 | 25-40 | NP-15 |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments | Percentage passing sieve number-- | | | | Liquid | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | > 3 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| McKenzie: | | | | | | | | | | | |
| 41*---------- | 0-4 | Clay---------- | CH | A-7 | 0 | 100 | 100 | 90-100 | 80-95 | 50-75 | 25-50 |
| | 4-60 | Clay---------- | CH | A-7 | 0 | 100 | 100 | 90-100 | 75-95 | 50-75 | 25-50 |
| Rentsac: | | | | | | | | | | | |
| 42---------- | 0-8 | Loam---------- | ML, CL-ML | A-4 | 0-5 | 95-100 | 95-100 | 85-95 | 60-75 | 25-35 | 5-10 |
| | 8-18 | Very channery loam. | GM | A-1 | 5-10 | 30-60 | 20-50 | 15-45 | 10-35 | --- | NP |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rock outcrop: | | | | | | | | | | | |
| 143*: | | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | | |
| Castner part---- | 0-10 | Loam---------- | ML, CL-ML | A-4 | 0-5 | 95-100 | 95-100 | 80-90 | 60-75 | 25-35 | 5-10 |
| | 10-18 | Very channery loam. | GM | A-2, A-4 | 15-25 | 50-60 | 40-50 | 35-45 | 20-40 | 25-35 | NP-10 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 144*: | | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | | |
| Garlet part----- | 0-12 | Cobbly loam----- | SM, ML | A-2, A-4 | 25-35 | 75-80 | 70-80 | 45-65 | 35-55 | 30-40 | 5-10 |
| | 12-53 | Gravelly sandy loam. | SM, GM | A-1, A-2 | 10-15 | 55-80 | 50-75 | 25-60 | 15-35 | 30-40 | 5-10 |
| | 53-60 | Very cobbly loam | ML, GM, CL-ML, GM-GC | A-2, A-4 | 65-75 | 55-80 | 45-70 | 40-65 | 25-55 | 25-35 | 5-10 |
| 145*: | | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | | |
| Yawdim part----- | 0-10 | Clay loam------- | CL, CH | A-7 | 0 | 100 | 100 | 90-100 | 70-95 | 40-75 | 25-50 |
| | 10 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sebud: | | | | | | | | | | | |
| 46*, 47*-------- | 0-4 | Stony loam------ | ML, SM | A-4 | 15-30 | 75-95 | 60-85 | 50-80 | 35-65 | 25-35 | NP-10 |
| | 4-10 | Very stony loam | ML, SM | A-4 | 25-40 | 75-95 | 60-85 | 50-80 | 35-55 | 25-35 | NP-10 |
| | 10-24 | Very stony clay loam. | CL, SC | A-6 | 25-40 | 75-95 | 60-85 | 50-85 | 40-70 | 30-40 | 10-15 |
| | 24-60 | Very stony sandy clay loam. | SC, SM-SC | A-2, A-4, A-6 | 25-40 | 75-95 | 60-85 | 45-75 | 20-45 | 25-35 | 5-15 |
| 148*: | | | | | | | | | | | |
| Sebud part------ | 0-4 | Stony loam------ | ML, SM | A-4 | 15-30 | 75-95 | 60-85 | 50-80 | 35-65 | 25-35 | NP-10 |
| | 4-10 | Very stony loam | ML, SM | A-4 | 25-40 | 75-95 | 60-85 | 50-80 | 35-55 | 25-35 | NP-10 |
| | 10-24 | Very stony clay loam. | CL, SC | A-6 | 25-40 | 75-95 | 60-85 | 50-85 | 40-70 | 30-40 | 10-15 |
| | 24-60 | Very stony sandy clay loam. | SC, SM-SC | A-2, A-4, A-6 | 25-40 | 75-95 | 60-85 | 45-75 | 20-45 | 25-35 | 5-15 |
| Cheadle part---- | 0-4 | Channery loam--- | GM-GC, SM-SC | A-2, A-4 | 0-10 | 55-75 | 60-70 | 45-60 | 30-45 | 20-30 | 5-10 |
| | 4-9 | Very flaggy loam, very channery loam. | GM | A-1 | 30-75 | 25-40 | 15-30 | 15-25 | 10-25 | 20-30 | NP-5 |
| | 9 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | > 3 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Shane: | | | | | | | | | | | |
| 49, 50 | 0-5 | Clay loam | CL | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 25-40 | 10-20 |
| | 5-30 | Clay, silty clay | CH | A-7 | 0 | 100 | 100 | 90-100 | 75-95 | 50-65 | 35-50 |
| | 30 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 151: | | | | | | | | | | | |
| Shane part | 0-5 | Clay loam | CL | A-6 | 0 | 100 | 100 | 90-100 | 70-80 | 25-40 | 10-20 |
| | 5-30 | Clay, silty clay | CH | A-7 | 0 | 100 | 100 | 90-100 | 75-95 | 50-65 | 35-50 |
| | 30 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cabba part | 0-5 | Clay loam | CL | A-6 | 0-5 | 95-100 | 85-100 | 75-90 | 60-80 | 30-40 | 10-15 |
| | 5-18 | Clay loam | CL | A-6 | 0-5 | 100 | 95-100 | 90-100 | 75-80 | 30-40 | 10-15 |
| | 18 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Shawa: | | | | | | | | | | | |
| 52 | 0-5 | Silty clay loam | CL | A-6, A-7 | 0-5 | 95-100 | 95-100 | 95-100 | 85-95 | 30-45 | 10-20 |
| | 5-60 | Clay loam | CL | A-6 | 0-5 | 95-100 | 95-100 | 95-100 | 75-80 | 30-40 | 10-20 |
| Tanna: | | | | | | | | | | | |
| 53, 54 | 0-7 | Clay loam | CL | A-6 | 0-5 | 90-100 | 90-100 | 85-95 | 70-80 | 25-40 | 10-20 |
| | 7-34 | Clay loam, clay, silty clay. | CL | A-6, A-7 | 0-5 | 90-100 | 90-100 | 80-95 | 75-90 | 35-45 | 15-25 |
| | 34 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 155: | | | | | | | | | | | |
| Tanna part | 0-7 | Clay loam | CL | A-6 | 0-5 | 90-100 | 90-100 | 85-95 | 70-80 | 25-40 | 10-20 |
| | 7-34 | Clay loam, clay, silty clay. | CL | A-6, A-7 | 0-5 | 90-100 | 90-100 | 80-95 | 75-90 | 35-45 | 15-25 |
| | 34 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Beenom part | 0-7 | Loam | CL-ML | A-4 | 0-10 | 85-100 | 85-100 | 85-95 | 50-70 | 20-30 | 5-10 |
| | 7-18 | Clay loam | CL | A-6 | 0-10 | 95-100 | 90-100 | 85-95 | 70-80 | 25-35 | 10-15 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 156: | | | | | | | | | | | |
| Tanna part | 0-7 | Clay loam | CL | A-6 | 0-5 | 90-100 | 90-100 | 85-95 | 70-80 | 25-40 | 10-20 |
| | 7-34 | Clay loam, clay, silty clay. | CL | A-6, A-7 | 0-5 | 90-100 | 90-100 | 80-95 | 75-90 | 35-45 | 15-25 |
| | 34 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rentsac part | 0-8 | Loam | ML, CL-ML | A-4 | 0-5 | 95-100 | 80-100 | 65-95 | 50-75 | 25-35 | 5-10 |
| | 8-18 | Very channery loam. | GM | A-1, A-2 | 5-10 | 30-60 | 20-50 | 15-45 | 10-35 | --- | NP |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rentsac part | 0-8 | Channery loam | GM, ML | A-2, A-4 | 5-10 | 50-80 | 35-75 | 30-65 | 25-55 | 20-35 | NP-10 |
| | 8-18 | Very channery loam. | GM | A-1, A-2 | 5-10 | 30-60 | 20-50 | 15-45 | 10-35 | --- | NP |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Torrifluvents: | | | | | | | | | | | |
| 157*: | | | | | | | | | | | |
| Torrifluvents part | 0-60 | Variable | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Camborthids part | 0-60 | Variable | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | > 3 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Turner: | | | | | | | | | | | |
| 58, 59 | 0-3 | Clay loam | CL | A-6 | 0-5 | 95-100 | 90-100 | 90-100 | 70-80 | 25-35 | 10-20 |
| | 3-22 | Clay loam, gravelly clay loam, cobbly clay loam. | CL | A-6 | 10-30 | 75-90 | 65-85 | 60-80 | 55-65 | 30-40 | 10-20 |
| | 22-60 | Sand, very gravelly sand. | SP-SM, SP, GP-GM, GP | A-1 | 5-20 | 35-85 | 25-75 | 15-50 | 0-10 | --- | NP |
| 60 | 0-3 | Stony clay loam | CL | A-6 | 25-35 | 85-95 | 80-90 | 70-85 | 60-75 | 25-35 | 10-20 |
| | 3-22 | Clay loam, gravelly clay loam, cobbly clay loam. | CL | A-6 | 15-35 | 75-900 | 65-850 | 60-90 | 55-65 | 30-40 | 10-20 |
| | 22-60 | Sand, loamy sand, very gravelly sand. | SP-SM, SP, GP-GM, GP | A-1 | 5-20 | 35-85 | 25-75 | 15-55 | 0-10 | --- | NP |
| Ustifluvents: | | | | | | | | | | | |
| [1]61*: | | | | | | | | | | | |
| Ustifluvents part | 0-60 | Variable | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Fluvaquents part | 0-60 | Variable | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]62*: | | | | | | | | | | | |
| Ustifluvents part | 0-60 | Variable | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ustochrepts part | 0-60 | Variable | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Wayden: | | | | | | | | | | | |
| [1]63*: | | | | | | | | | | | |
| Wayden part | 0-6 | Clay loam | CL, CH | A-6, A-7 | 0 | 100 | 100 | 90-100 | 75-85 | 35-55 | 15-35 |
| | 6-14 | Clay loam, clay, silty clay. | CH, CL | A-7 | 0 | 100 | 100 | 90-100 | 75-85 | 40-75 | 20-50 |
| | 14 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Castner part | 0-10 | Channery loam | SM, SM-SC, ML, CL-ML | A-4 | 5-20 | 75-85 | 60-75 | 50-60 | 35-55 | 25-35 | 5-10 |
| | 10-18 | Very channery loam. | GM | A-2, A-4, A-1 | 15-25 | 50-60 | 40-50 | 35-45 | 20-40 | 25-35 | NP-10 |
| | 18 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Winkler: | | | | | | | | | | | |
| [1]64*: | | | | | | | | | | | |
| Winkler part | 0-15 | Gravelly sandy loam. | GM, SM | A-1 | 0-5 | 55-75 | 50-60 | 30-40 | 15-25 | --- | NP |
| | 15-60 | Very gravelly sandy loam. | GM-GC | A-2 | 0-5 | 25-55 | 20-50 | 10-35 | 5-25 | 20-30 | 5-10 |
| Hilger part | 0-4 | Cobbly sandy loam. | SM | A-1, A-2 | 30-50 | 70-90 | 60-90 | 35-65 | 20-35 | --- | NP |
| | 4-24 | Very cobbly clay loam, very cobbly loam, very cobbly sandy clay loam | SC, SM-SC, ML, CL-ML | A-2, A-4, A-6 | 50-60 | 70-85 | 60-75 | 50-70 | 30-60 | 25-35 | 5-15 |
| | 24-60 | Very cobbly loam | GM, SM | A-1, A-2, A-4 | 65-90 | 45-80 | 35-70 | 30-65 | 20-50 | 20-35 | NP-10 |

See footnote at end of table.

TABLE 9.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | > 3 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Winkler--continued | | | | | | | | | | | |
| [1]64*: | | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | | |
| Work: | | | | | | | | | | | |
| 65, 66 | 0-5 | Loam | CL, CL-ML | A-6, A-4 | 0-10 | 90-100 | 90-100 | 85-95 | 60-75 | 25-35 | 5-15 |
| | 5-28 | Clay, clay loam | CL, CH | A-7 | 0-10 | 90-100 | 90-100 | 90-100 | 75-90 | 40-55 | 20-30 |
| | 28-60 | Gravelly loam | ML, SM | A-4 | 0-10 | 60-85 | 50-75 | 45-70 | 35-55 | 25-35 | NP-10 |
| Yamac: | | | | | | | | | | | |
| 67, 68, 69, 70 | 0-8 | Loam | ML | A-4, A-6 | 0 | 95-100 | 95-100 | 85-95 | 60-75 | 20-40 | NP-15 |
| | 8-60 | Loam | ML | A-4, A-6 | 0 | 95-100 | 95-100 | 85-95 | 60-75 | 20-40 | NP-15 |
| Yawdim: | | | | | | | | | | | |
| [1]71*: | | | | | | | | | | | |
| Yawdim part | 0-10 | Clay loam | CL, CH | A-7 | 0 | 100 | 100 | 90-100 | 70-95 | 40-75 | 25-50 |
| | 10 | Weathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lambeth part | 0-8 | Silt loam | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| | 8-60 | Silt loam | ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 25-40 | NP-15 |
| Rock outcrop part. | | | | | | | | | | | |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Salinity | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T | Wind erodibility group |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | Mmhos/cm | | | | | | |
| Absarokee: | | | | | | | | | | | |
| 1, 2 | 0-6 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 2 | 5 |
| | 6-35 | 0.2-0.6 | 0.12-0.16 | 6.6-8.4 | <2 | High | Moderate | Low | 0.32 | | |
| | 35 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| [1]3: | | | | | | | | | | | |
| Absarokee part | 0-6 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 2 | 5 |
| | 6-35 | 0.2-0.6 | 0.12-0.16 | 6.6-8.4 | <2 | High | Moderate | Low | 0.32 | | |
| | 35 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Sinnigam part | 0-5 | 0.2-0.6 | 0.12-0.18 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 1 | 6 |
| | 5-18 | 0.2-0.6 | 0.09-0.13 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.20 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| [1]4: | | | | | | | | | | | |
| Absarokee part | 0-6 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 2 | 5 |
| | 6-35 | 0.2-0.6 | 0.12-0.16 | 6.6-8.4 | <2 | High | Moderate | Low | 0.32 | | |
| | 35 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Sinnigam part | 0-5 | 0.2-0.6 | 0.12-0.18 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 1 | 6 |
| | 5-18 | 0.2-0.6 | 0.09-0.13 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.20 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| [1]5*: | | | | | | | | | | | |
| Absarokee part | 0-6 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 2 | 5 |
| | 6-24 | 0.2-0.6 | 0.12-0.16 | 6.6-8.4 | <2 | High | Moderate | Low | 0.32 | | |
| | 24 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Sinnigam part | 0-5 | 0.6-2.0 | 0.09-0.13 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 1 | 5 |
| | 5-18 | 0.2-0.6 | 0.09-0.13 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.20 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| [1]6: | | | | | | | | | | | |
| Absarokee part | 0-6 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 2 | 5 |
| | 6-24 | 0.2-0.6 | 0.12-0.16 | 6.6-8.4 | <2 | High | Moderate | Low | 0.32 | | |
| | 24 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Amherst part | 0-4 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.37 | 1 | 5 |
| | 4-18 | 0.6-2.0 | 0.11-0.14 | 6.6-7.3 | <2 | Moderate | High | Low | 0.28 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Castner part | 0-10 | 0.6-2.0 | 0.16-0.20 | 6.6-7.8 | <2 | Low | High | Low | 0.32 | 1 | 5 |
| | 10-18 | 0.6-2.0 | 0.04-0.09 | 6.6-8.4 | <2 | Low | High | Low | 0.24 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Absher: | | | | | | | | | | | |
| 7 | 0-5 | <0.06 | 0.14-0.18 | 7.4-8.4 | 4-8 | Moderate | High | Moderate | 0.49 | 5 | 7 |
| | 5-60 | <0.06 | 0.12-0.16 | 7.4-8.4 | 8-16 | High | High | Moderate | 0.49 | | |
| Amherst: | | | | | | | | | | | |
| [1]8: | | | | | | | | | | | |
| Amherst part | 0-4 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.37 | 1 | 5 |
| | 4-18 | 0.6-2.0 | 0.11-0.14 | 6.6-7.3 | <2 | Moderate | High | Low | 0.28 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Absarokee part | 0-6 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | 2 | 5 |
| | 6-24 | 0.2-0.6 | 0.12-0.16 | 6.6-8.4 | <2 | High | Moderate | Low | 0.32 | | |
| | 24 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Castner part | 0-10 | 0.6-2.0 | 0.16-0.20 | 6.6-7.8 | <2 | Low | High | Low | 0.32 | 1 | 5 |
| | 10-18 | 0.6-2.0 | 0.04-0.09 | 6.6-8.4 | <2 | Low | High | Low | 0.24 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Salinity | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T | Wind erodibility group |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | Mmhos/cm | | | | | | |
| Assinniboine: | | | | | | | | | | | |
| 9 | 0-6 | 2.0-6.0 | 0.10-0.11 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.24 | 5 | 3 |
| | 6-20 | 0.6-2.0 | 0.12-0.14 | 7.4-7.8 | <2 | Moderate | High | Low | 0.32 | | |
| | 20-60 | 2.0-6.0 | 0.10-0.11 | 7.9-8.4 | <2 | Low | High | Low | 0.32 | | |
| [1]10: | | | | | | | | | | | |
| Assinniboine part | 0-6 | 2.0-6.0 | 0.10-0.11 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.24 | 5 | 3 |
| | 6-20 | 0.6-2.0 | 0.12-0.14 | 7.4-7.8 | <2 | Moderate | High | Low | 0.32 | | |
| | 20-60 | 2.0-6.0 | 0.10-0.11 | 7.9-8.4 | <2 | Low | High | Low | 0.32 | | |
| Rentsac part | 0-8 | 0.6-2.0 | 0.09-0.14 | 7.4-7.8 | <2 | Low | High | Low | 0.37 | 1 | 5 |
| | 8-18 | 2.0-6.0 | 0.04-0.10 | 7.9-8.4 | <4 | Low | High | Low | 0.24 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Attewan: | | | | | | | | | | | |
| 11, 12 | 0-9 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.37 | 3 | 5 |
| | 9-18 | 0.6-2.0 | 0.12-0.18 | 6.6-7.3 | <2 | Moderate | High | Low | 0.32 | | |
| | 18-28 | 0.6-2.0 | 0.10-0.19 | 7.9-8.4 | <2 | Low | High | Low | 0.37 | | |
| | 28-60 | >20 | 0.01-0.04 | 7.9-8.4 | <2 | Low | High | Low | 0.10 | | |
| [1]13: | | | | | | | | | | | |
| Attewan part | 0-9 | 0.6-2.0 | 0.10-0.14 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.37 | 3 | 5 |
| | 9-18 | 0.6-2.0 | 0.12-0.18 | 6.6-7.8 | <2 | Moderate | High | Low | 0.32 | | |
| | 18-28 | 0.6-2.0 | 0.10-0.19 | 7.4-8.4 | <2 | Low | High | Low | 0.37 | | |
| | 28-60 | >20 | 0.01-0.04 | 7.4-8.4 | <2 | Low | High | Low | 0.10 | | |
| Beaverell part | 0-6 | 0.6-2.0 | 0.11-0.14 | 6.6-7.8 | <2 | Low | High | Low | 0.32 | 2 | 5 |
| | 6-12 | 0.6-2.0 | 0.05-0.09 | 6.6-7.8 | <2 | Moderate | High | Low | 0.24 | | |
| | 12-60 | >20 | 0.01-0.08 | 7.4-7.8 | <2 | Low | High | Low | 0.10 | | |
| Beaverell: | | | | | | | | | | | |
| 14 | 0-6 | 0.6-2.0 | 0.05-0.09 | 6.6-7.3 | <2 | Low | High | Low | 0.28 | 2 | 4 |
| | 6-12 | 0.6-2.0 | 0.05-0.09 | 6.6-7.3 | <2 | Moderate | High | Low | 0.24 | | |
| | 12-60 | >20 | 0.01-0.08 | 7.9-8.4 | <2 | Low | High | Low | 0.10 | | |
| Birney: | | | | | | | | | | | |
| [1]15*: | | | | | | | | | | | |
| Birney part | 0-4 | 0.6-2.0 | 0.11-0.13 | 7.4-8.4 | <2 | Low | High | Low | 0.28 | 5 | 8 |
| | 4-14 | 0.6-2.0 | 0.05-0.13 | 7.4-8.4 | <2 | Low | High | Low | 0.24 | | |
| | 14-60 | 2.0-6.0 | 0.03-0.06 | 7.9-9.0 | <4 | Low | High | Low | 0.15 | | |
| Yawdim part | 0-15 | 0.06-0.2 | 0.14-0.19 | 8.5-9.0 | <2 | High | High | Moderate | 0.32 | 2 | 4L |
| | 15 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Rock outcrop part. | | | | | | | | | | | |
| Bonfri: | | | | | | | | | | | |
| [1]16: | | | | | | | | | | | |
| Bonfri part | 0-7 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.37 | 2 | 5 |
| | 7-23 | 0.2-0.6 | 0.12-0.18 | 6.6-7.3 | <2 | Moderate | High | Low | 0.32 | | |
| | 23-36 | 0.2-0.6 | 0.12-0.18 | 7.4-8.4 | 2-4 | Moderate | High | Low | 0.32 | | |
| | 36 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Lambeth part | 0-8 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <2 | Low | High | Low | 0.43 | 5 | 6 |
| | 8-60 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <4 | Low | High | Low | 0.43 | | |
| [1]17: | | | | | | | | | | | |
| Bonfri part | 0-7 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.37 | 2 | 5 |
| | 7-23 | 0.2-0.6 | 0.12-0.18 | 6.6-7.3 | <2 | Moderate | High | Low | 0.32 | | |
| | 23-36 | 0.2-0.6 | 0.12-0.18 | 7.4-8.4 | 2-4 | Moderate | High | Low | 0.32 | | |
| | 36 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Lambeth part | 0-8 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <2 | Low | High | Low | 0.43 | 5 | 6 |
| | 8-60 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <4 | Low | High | Low | 0.43 | | |

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Salinity | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T | Wind erodibility group |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | Mmhos/cm | | | | | | |
| Garlet: | | | | | | | | | | | |
| [1]18*: | | | | | | | | | | | |
| Garlet part----- | 0-12 | 2.0-6.0 | 0.13-0.19 | 6.6-7.3 | <2 | Low------- | High----- | Moderate | 0.24 | 5 | 8 |
| | 12-53 | 0.6-2.0 | 0.05-0.07 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | --- | | |
| | 53-60 | 0.6-2.0 | 0.04-0.06 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | --- | | |
| Sebud part------ | 0-4 | 0.6-2.0 | 0.08-0.10 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | 0.32 | 5 | 8 |
| | 4-10 | 0.6-2.0 | 0.07-0.10 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | 0.28 | | |
| | 10-24 | 0.6-2.0 | 0.06-0.09 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.32 | | |
| | 24-60 | 0.6-2.0 | 0.05-0.07 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.28 | | |
| Glendive: | | | | | | | | | | | |
| 19, 20---------- | 0-6 | 0.6-2.0 | 0.09-0.12 | 6.6-8.4 | <4 | Low------- | High----- | Low------ | 0.20 | 5 | 5 |
| | 6-60 | 2.0-6.0 | 0.09-0.12 | 7.4-7.8 | 2-8 | Low------- | High----- | Low------ | 0.20 | | |
| Grail: | | | | | | | | | | | |
| 21, 22---------- | 0-13 | 0.2-0.6 | 0.22-0.24 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.37 | 5 | 6 |
| | 13-24 | 0.2-0.6 | 0.14-0.17 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.37 | | |
| | 24-60 | 0.2-0.6 | 0.13-0.22 | 7.9-8.4 | <2 | Moderate | High----- | Low------ | 0.37 | | |
| Harlem: | | | | | | | | | | | |
| 23, 24---------- | 0-9 | 0.06-0.2 | 0.12-0.18 | 7.4-8.4 | <4 | Moderate | High----- | Low------ | 0.32 | 5 | 6 |
| | 9-60 | 0.06-0.2 | 0.14-0.18 | 7.4-8.4 | <4 | High------ | High----- | Low------ | 0.32 | | |
| Havre: | | | | | | | | | | | |
| 25, 26, 27------- | 0-6 | 0.6-2.0 | 0.16-0.20 | 7.4-8.4 | <2 | Low------- | High----- | Low------ | 0.28 | 5 | 5 |
| | 6-60 | 0.6-2.0 | 0.15-0.20 | 8.5-9.0 | <8 | Low------- | High----- | Low------ | 0.28 | | |
| Hilger: | | | | | | | | | | | |
| [1]28*: | | | | | | | | | | | |
| Hilger part----- | 0-4 | 2.0-6.0 | 0.05-0.08 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | 0.20 | 5 | 3 |
| | 4-24 | 0.6-2.0 | 0.05-0.07 | 7.9-8.4 | <2 | Low------- | High----- | Low------ | 0.32 | | |
| | 24-60 | 0.6-2.0 | 0.05-0.07 | 7.9-8.4 | <2 | Low------- | High----- | Low------ | 0.32 | | |
| Castner part---- | 0-10 | 0.6-2.0 | 0.06-0.10 | 6.6-7.8 | <2 | Low------- | High----- | Low------ | 0.28 | 1 | 8 |
| | 10-18 | 0.6-2.0 | 0.04-0.09 | 6.6-8.4 | <2 | Low------- | High----- | Low------ | 0.17 | | |
| | 18 | --- | --- | --- | --- | ---------- | --------- | --------- | --- | | |
| Rock outcrop part. | | | | | | | | | | | |
| Kobar: | | | | | | | | | | | |
| 29, 30---------- | 0-5 | 0.2-0.6 | 0.14-0.18 | 7.4-7.8 | <2 | Moderate | High----- | Low------ | 0.32 | 5 | 6 |
| | 5-60 | 0.2-0.6 | 0.14-0.20 | 7.4-8.4 | <2 | High------ | High----- | Low------ | 0.37 | | |
| Lambeth: | | | | | | | | | | | |
| 31---------- | 0-8 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <2 | Low------- | High----- | Low------ | 0.43 | 5 | 6 |
| | 8-60 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <4 | Low------- | High----- | Low------ | 0.43 | | |
| [1]32: | | | | | | | | | | | |
| Lambeth part---- | 0-8 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <2 | Low------- | High----- | Low------ | 0.43 | 5 | 6 |
| | 8-60 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <4 | Low------- | High----- | Low------ | 0.43 | | |
| Rentsac part---- | 0-8 | 0.6-2.0 | 0.16-0.20 | 7.4-7.8 | <2 | Low------- | High----- | Low------ | 0.37 | 1 | 5 |
| | 8-18 | 0.6-2.0 | 0.04-0.10 | 7.4-8.4 | <4 | Low------- | High----- | Low------ | 0.24 | | |
| | 18 | --- | --- | --- | --- | ---------- | --------- | --------- | --- | | |
| [1]33: | | | | | | | | | | | |
| Lambeth part---- | 0-8 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <2 | Low------- | High----- | Low------ | 0.43 | 5 | 6 |
| | 8-60 | 0.2-0.6 | 0.18-0.22 | 7.8-8-4 | <4 | Low------- | High----- | Low------ | 0.43 | | |
| Yawdim part----- | 0-10 | 0.06-0.2 | 0.14-0.19 | 8.5-9.0 | <2 | High------ | High----- | Moderate | 0.32 | 2 | 4L |
| | 10 | --- | --- | --- | --- | ---------- | --------- | --------- | --- | | |

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Salinity | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T | Wind erodibility group |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | Mmhos/cm | | | | | | |
| Lardell: | | | | | | | | | | | |
| 34*---------- | 0-7 | 0.06-0.6 | 0.10-0.14 | 7.9-8.4 | >16 | Moderate | High----- | High----- | --- | --- | 6 |
| | 7-60 | 0.06-0.2 | 0.10-0.14 | 8.5-9.0 | >16 | Moderate | High----- | High----- | --- | | |
| Lohler: | | | | | | | | | | | |
| 35, 36---------- | 0-9 | 0.2-0.6 | 0.18-0.24 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.37 | 4 | 6 |
| | 9-60 | 0.2-0.6 | 0.13-0.17 | 7.4-7.8 | <2 | High------ | High----- | Low------ | 0.37 | | |
| Lolo: | | | | | | | | | | | |
| [1]37: | | | | | | | | | | | |
| Lolo part------- | 0-13 | 2.0-6.0 | 0.04-0.08 | 6.6-7.3 | <2 | Low------- | Moderate- | Low------ | 0.20 | 5 | 5 |
| | 13-24 | 2.0-6.0 | 0.06-0.08 | 7.4-8.4 | <2 | Low------- | High----- | Low------ | 0.20 | | |
| | 24-60 | 2.0-6.0 | 0.06-0.08 | 7.4-8.4 | <2 | Low------- | High----- | Low------ | 0.20 | | |
| Lolo part------- | 0-13 | 2.0-6.0 | 0.08-0.10 | 6.6-7.3 | <2 | Low------- | Moderate | Low------ | 0.24 | 5 | 5 |
| | 13-24 | 2.0-6.0 | 0.10-0.14 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | 0.20 | | |
| | 24-60 | 2.0-6.0 | 0.06-0.08 | 7.4-8.4 | <2 | Low------- | High----- | Low------ | 0.20 | | |
| [1]38*: | | | | | | | | | | | |
| Lolo part------- | 0-13 | 2.0-6.0 | 0.04-0.08 | 6.6-7.3 | <2 | Low------- | Moderate | Low------ | 0.20 | 5 | 8 |
| | 13-24 | 2.0-6.0 | 0.04-0.08 | 7.4-8.4 | <2 | Low------- | High----- | Low------ | 0.20 | | |
| | 24-60 | 2.0-6.0 | 0.04-0.08 | 7.4-8.4 | <2 | Low------- | High----- | Low------ | 0.20 | | |
| Nesda part------ | 0-16 | 0.6-2.0 | 0.10-0.15 | 6.6-7.8 | <2 | Low------- | High----- | Low------ | --- | --- | 5 |
| | 16-60 | >6.0 | 0.02-0.04 | 7.4-8.4 | <2 | Low------- | High----- | Low------ | --- | | |
| Lonna: | | | | | | | | | | | |
| 39, 40---------- | 0-2 | 0.6-2.0 | 0.18-0.22 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.37 | 5 | 6 |
| | 2-28 | 0.6-2.0 | 0.16-0.22 | 7.9-8.4 | <4 | Moderate | High----- | Low------ | 0.37 | | |
| | 28-60 | 0.6-2.0 | 0.18-0.22 | 7.9-8.4 | <4 | Low------- | High----- | Low------ | 0.49 | | |
| McKenzie: | | | | | | | | | | | |
| 41*---------- | 0-4 | <0.06 | 0.06-0.09 | 7.9-8.4 | 8-16 | High------ | High----- | High----- | --- | --- | 8 |
| | 4-60 | <0.06 | 0.06-0.09 | 8.5-9.0 | 8-16 | High------ | High----- | High----- | --- | | |
| Rentsac: | | | | | | | | | | | |
| 42---------- | 0-8 | 0.6-2.0 | 0.16-0.20 | 7.4-7.8 | <2 | Low------- | High----- | Low------ | 0.37 | 1 | 5 |
| | 8-18 | 0.6-2.0 | 0.04-0.10 | 7.4-8.4 | <4 | Low------- | High----- | Low------ | 0.24 | | |
| | 18 | --- | --- | --- | --- | ---------- | --------- | --------- | --- | | |
| Rock outcrop: | | | | | | | | | | | |
| [1]43*: | | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | | |
| Castner part---- | 0-10 | 0.6-2.0 | 0.16-0.20 | 6.6-7.8 | <2 | Low------- | High----- | Low------ | 0.32 | 1 | 5 |
| | 10-18 | 0.6-2.0 | 0.04-0.09 | 6.6-8.4 | <2 | Low------- | High----- | Low------ | 0.24 | | |
| | 18 | --- | --- | --- | --- | ---------- | --------- | --------- | --- | | |
| [1]44*: | | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | | |
| Garlet part----- | 0-12 | 2.0-6.0 | 0.13-0.19 | 6.6-7.3 | <2 | Low------- | High----- | Moderate | 0.24 | 5 | 5 |
| | 12-53 | 0.6-2.0 | 0.05-0.07 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | --- | | |
| | 53-60 | 0.6-2.0 | 0.04-0.06 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | --- | | |
| [1]45*: | | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | | |
| Yawdim part----- | 0-10 | 0.06-0.2 | 0.14-0.19 | 8.5-9.0 | <2 | High------ | High----- | Moderate | 0.32 | 2 | 4L |
| | 10 | --- | --- | --- | --- | ---------- | --------- | --------- | --- | | |
| Sebud: | | | | | | | | | | | |
| 46*, 47*-------- | 0-4 | 0.6-2.0 | 0.08-0.10 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | 0.32 | 5 | 8 |
| | 4-10 | 0.6-2.0 | 0.07-0.10 | 6.6-7.3 | <2 | Low------- | High----- | Low------ | 0.28 | | |
| | 10-24 | 0.6-2.0 | 0.06-0.09 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.32 | | |
| | 24-60 | 0.6-2.0 | 0.05-0.07 | 6.6-7.3 | <2 | Moderate | High----- | Low------ | 0.28 | | |

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Salinity | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T | Wind erodibility group |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | Mmhos/cm | | | | | | |
| Sebud--continued | | | | | | | | | | | |
| 148*: | | | | | | | | | | | |
| Sebud part | 0-4 | 0.6-2.0 | 0.08-0.10 | 6.6-7.3 | <2 | Low | High | Low | 0.32 | 5 | 8 |
| | 4-10 | 0.6-2.0 | 0.07-0.10 | 6.6-7.3 | <2 | Low | High | Low | 0.28 | | |
| | 10-24 | 0.6-2.0 | 0.06-0.09 | 6.6-7.3 | <2 | Moderate | High | Low | 0.32 | | |
| | 24-60 | 0.6-2.0 | 0.05-0.07 | 6.6-7.3 | <2 | Moderate | High | Low | 0.28 | | |
| Cheadle part | 0-4 | 0.6-2.0 | 0.12-0.18 | 6.6-7.8 | <2 | Low | High | Low | 0.37 | 1 | 8 |
| | 4-9 | 0.6-2.0 | 0.08-0.10 | 7.9-8.4 | 2-4 | Low | High | Low | 0.37 | | |
| | 9 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Shane: | | | | | | | | | | | |
| 49, 50 | 0-5 | 0.2-0.6 | 0.12-0.18 | 5.6-7.3 | <2 | Moderate | High | Low | 0.43 | 2 | 6 |
| | 5-30 | <0.06 | 0.12-0.18 | 7.4-8.4 | <4 | High | High | Low | 0.32 | | |
| | 30 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| 151: | | | | | | | | | | | |
| Shane part | 0-5 | 0.2-0.6 | 0.12-0.18 | 6.6-7.3 | <2 | Moderate | High | Low | 0.43 | 2 | 6 |
| | 5-30 | <0.06 | 0.12-0.18 | 7.4-8.4 | <4 | High | High | Low | 0.32 | | |
| | 30 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Cabba part | 0-5 | 0.6-2.0 | 0.12-0.15 | 7.9-8.4 | <4 | Moderate | High | Low | 0.37 | 4 | 6 |
| | 5-18 | 0.6-2.0 | 0.12-0.19 | 7.9-8.4 | 2-8 | Moderate | High | Low | 0.37 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Shawa: | | | | | | | | | | | |
| 52 | 0-5 | 0.6-2.0 | 0.16-0.18 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.28 | 5 | 5 |
| | 5-60 | 0.6-2.0 | 0.14-0.16 | 6.6-7.3 | <2 | Moderate | Moderate | Low | 0.32 | | |
| Tanna: | | | | | | | | | | | |
| 53, 54 | 0-7 | 0.06-0.2 | 0.12-0.18 | 7.4-7.8 | <2 | Moderate | High | Low | 0.37 | 2 | 6 |
| | 7-34 | 0.06-0.2 | 0.12-0.18 | 7.8-8.4 | <4 | Moderate | High | Low | 0.43 | | |
| | 34 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| 155: | | | | | | | | | | | |
| Tanna part | 0-7 | 0.06-0.2 | 0.12-0.18 | 7.4-7.8 | <2 | Moderate | High | Low | 0.37 | 2 | 6 |
| | 7-34 | 0.06-0.2 | 0.12-0.18 | 7.8-8.4 | <4 | Moderate | High | Low | 0.43 | | |
| | 34 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Beenom part | 0-7 | 0.6-2.0 | 0.14-0.20 | 7.4-7.8 | <2 | Low | High | Low | 0.37 | 1 | 5 |
| | 7-18 | 0.6-2.0 | 0.10-0.18 | 7.4-7.8 | <2 | Moderate | High | Low | 0.32 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| 156: | | | | | | | | | | | |
| Tanna part | 0-7 | 0.06-0.2 | 0.12-0.18 | 7.4-7.8 | <2 | Moderate | High | Low | 0.37 | 2 | 6 |
| | 7-34 | 0.06-0.2 | 0.12-0.18 | 7.8-8.4 | <4 | Moderate | High | Low | 0.43 | | |
| | 34 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Rentsac part | 0-8 | 0.6-2.0 | 0.16-0.20 | 7.4-7.8 | <2 | Low | High | Low | 0.37 | 1 | 5 |
| | 8-18 | 2.0-6.0 | 0.04-0.10 | 7.4-8.4 | <4 | Low | High | Low | 0.24 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Rentsac part | 0-8 | 0.6-2.0 | 0.09-0.14 | 7.4-7.8 | <2 | Low | High | Low | 0.37 | 1 | 5 |
| | 8-18 | 2.0-6.0 | 0.04-0.10 | 7.4-8.4 | <4 | Low | High | Low | 0.24 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Torrifluvents: | | | | | | | | | | | |
| 157*: | | | | | | | | | | | |
| Torrifluvents part | 0-60 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Camborthids part | 0-60 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Turner: | | | | | | | | | | | |
| 58, 59, 60 | 0-3 | 0.6-2.0 | 0.16-0.20 | 6.6-7.3 | <2 | Moderate | High | Low | 0.32 | 3 | 6 |
| | 3-22 | 0.6-2.0 | 0.14-0.18 | 7.4-8.4 | <2 | Moderate | High | Low | 0.32 | | |
| | 22-60 | 6.0-20 | <0.03 | 7.9-8.4 | <2 | Low | High | Low | 0.10 | | |

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Salinity | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T | Wind erodibility group |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | Mmhos/cm | | | | | | |
| Ustifluvents: | | | | | | | | | | | |
| [1]61*: | | | | | | | | | | | |
| Ustifluvents part | 0-60 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Fluvaquents part | 0-60 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [1]62*: | | | | | | | | | | | |
| Ustifluvents part | 0-60 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ustochrepts part | 0-60 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Wayden: | | | | | | | | | | | |
| [1]63*: | | | | | | | | | | | |
| Wayden part | 0-6 | 0.06-0.2 | 0.14-0.19 | 7.4-8.4 | 2-8 | Moderate | High | Moderate | 0.37 | 2-1 | 4L |
| | 6-14 | 0.06-0.2 | 0.12-0.18 | 7.4-8.4 | <8 | High | High | Moderate | 0.43 | | |
| | 14 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Castner part | 0-10 | 0.6-2.0 | 0.08-0.12 | 6.6-7.8 | <2 | Low | High | Low | 0.28 | 1 | 8 |
| | 10-18 | 0.6-2.0 | 0.04-0.09 | 6.6-8.4 | <2 | Low | High | Low | 0.24 | | |
| | 18 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Winkler: | | | | | | | | | | | |
| [1]64*: | | | | | | | | | | | |
| Winkler part | 0-15 | 2.0-6.0 | 0.08-0.11 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.20 | 5 | 8 |
| | 15-60 | 2.0-6.0 | 0.04-0.08 | 6.6-7.3 | <2 | Low | Moderate | Low | 0.17 | | |
| Hilger part | 0-4 | 2.0-6.0 | 0.05-0.08 | 6.6-7.3 | <2 | Low | High | Low | 0.20 | 5 | 3 |
| | 4-24 | 0.6-2.0 | 0.05-0.07 | 6.6-7.3 | <2 | Low | High | Low | 0.32 | | |
| | 24-60 | 0.6-2.0 | 0.05-0.07 | 7.4-7.8 | <2 | Low | High | Low | 0.32 | | |
| Rock outcrop part. | | | | | | | | | | | |
| Work: | | | | | | | | | | | |
| 65, 66 | 0-5 | 0.6-2.0 | 0.14-0.20 | 6.6-7.3 | <2 | Moderate | High | Low | 0.37 | 5 | 5 |
| | 5-28 | 0.2-0.6 | 0.12-0.18 | 6.6-7.8 | <2 | High | High | Low | 0.37 | | |
| | 28-60 | 0.6-2.0 | 0.12-0.14 | 7.9-9.0 | <4 | Low | High | Low | 0.28 | | |
| Yamac: | | | | | | | | | | | |
| 67, 68, 69, 70 | 0-8 | 0.6-2.0 | 0.14-0.20 | 7.4-7.8 | <2 | Low | High | Low | 0.37 | 5 | 5 |
| | 8-60 | 0.6-2.0 | 0.14-0.20 | 7.9-8.4 | <4 | Low | High | Low | 0.37 | | |
| Yawdim: | | | | | | | | | | | |
| [1]71*: | | | | | | | | | | | |
| Yawdim part | 0-10 | 0.06-0.2 | 0.14-0.19 | 8.5-9.0 | <2 | High | High | Moderate | 0.32 | 2 | 4L |
| | 10 | --- | --- | --- | --- | --- | --- | --- | --- | | |
| Lambeth part | 0-8 | 0.2-0.6 | 0.18-0.22 | 7.8-8.4 | <2 | Low | High | Low | 0.43 | 5 | 6 |
| | 8-60 | 0.2-0.6 | 0.18-0.22 | 7.9-8.4 | <4 | Low | High | Low | 0.43 | | |
| Rock outcrop part. | | | | | | | | | | | |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 11.--SOIL AND WATER FEATURES

[The descriptions of "flooding" and "water table" in the glossary explain terms such as "rare," "brief," and "apparent." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Potential frost action |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | |
| | | | | | Ft | | | In | | |
| Absarokee: | | | | | | | | | | |
| 1, 2 | C | None | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Low. |
| [1]3: | | | | | | | | | | |
| Absarokee part | C | None | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Low. |
| Sinnigam part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| [1]4: | | | | | | | | | | |
| Absarokee part | C | None | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Low. |
| Sinnigam part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| [1]5*: | | | | | | | | | | |
| Absarokee part | C | None | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Low. |
| Sinnigam part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| [1]6: | | | | | | | | | | |
| Absarokee part | C | None | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Low. |
| Amherst part | D | None | --- | --- | >6.0 | --- | --- | 6-20 | Hard | Low. |
| Castner part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Absher: | | | | | | | | | | |
| 7 | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | Low. |
| Amherst: | | | | | | | | | | |
| [1]8: | | | | | | | | | | |
| Amherst part | D | None | --- | --- | >6.0 | --- | --- | 6-20 | Hard | Low. |
| Absarokee part | C | None | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Low. |
| Castner part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Assinniboine: | | | | | | | | | | |
| 9 | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| [1]10: | | | | | | | | | | |
| Assinniboine part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Rentsac part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Attewan: | | | | | | | | | | |
| 11 | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| 12 | B | None | --- | --- | 0.5-2.0 | Apparent | May-Aug | >60 | --- | Moderate. |
| [1]13: | | | | | | | | | | |
| Attewan part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Beaverell part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Beaverell: | | | | | | | | | | |
| 14 | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Birney: | | | | | | | | | | |
| [1]15*: | | | | | | | | | | |
| Birney part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Low. |
| Yawdim part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Rippable | Low. |
| Rock outcrop part. | | | | | | | | | | |

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Potential frost action |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | |
| | | | | | Ft | | | In | | |
| Bonfri: | | | | | | | | | | |
| [1]16: | | | | | | | | | | |
| Bonfri part---- | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Rippable | Moderate. |
| Lambeth part--- | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| [1]17: | | | | | | | | | | |
| Bonfri part---- | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Rippable | Moderate. |
| Lambeth part--- | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Garlet: | | | | | | | | | | |
| [1]18*: | | | | | | | | | | |
| Garlet part---- | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Sebud part----- | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Glendive: | | | | | | | | | | |
| 19---------- | B | Rare-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| 20---------- | B | Occasional | Brief----- | Apr-Jun | >6.0 | --- | --- | >60 | --- | Moderate. |
| Grail: | | | | | | | | | | |
| 21, 22------ | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Harlem: | | | | | | | | | | |
| 23---------- | C | Rare-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Low. |
| 24---------- | C | Occasional | Brief----- | Apr-Jun | >5.0 | --- | --- | >60 | --- | Low. |
| Havre: | | | | | | | | | | |
| 25, 26------ | B | Rare-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| 27---------- | B | Occasional | Brief----- | Apr-Jun | >6.0 | --- | --- | >60 | --- | Moderate. |
| Hilger: | | | | | | | | | | |
| [1]28*: | | | | | | | | | | |
| Hilger part---- | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Castner part--- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Rock outcrop part. | | | | | | | | | | |
| Kobar: | | | | | | | | | | |
| 29, 30------ | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Low. |
| Lambeth: | | | | | | | | | | |
| 31---------- | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| [1]32: | | | | | | | | | | |
| Lambeth part--- | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Rentsac part--- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| [1]33: | | | | | | | | | | |
| Lambeth part--- | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Yawdim part---- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Rippable | Low. |
| Lardell: | | | | | | | | | | |
| 34*--------- | C | Rare-------- | --- | --- | 1.0-5.0 | Apparent | May-Aug | >60 | --- | Moderate. |
| Lohler: | | | | | | | | | | |
| 35, 36------ | B | Rare-------- | --- | --- | --- | --- | --- | >60 | --- | Moderate. |
| Lolo: | | | | | | | | | | |
| [1]37: | | | | | | | | | | |
| Lolo part------ | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Potential frost action |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | |
| | | | | | Ft | | | In | | |
| Lolo--continued | | | | | | | | | | |
| Lolo part------ | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| [1]38*: | | | | | | | | | | |
| Lolo part------ | B | Occasional | Brief----- | Apr-Jun | 0.8-2.5 | Apparent | May-Aug | >60 | --- | Moderate. |
| Nesda part----- | B | Occasional | Brief----- | Apr-Jun | >6.0 | --- | --- | >60 | --- | Low. |
| Lonna: | | | | | | | | | | |
| 39, 40---------- | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| McKenzie: | | | | | | | | | | |
| 41*--------------- | D | Common------ | Long------ | Apr-Aug | >6.0 | --- | --- | >60 | --- | Low. |
| Rentsac: | | | | | | | | | | |
| 42---------------- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Rock outcrop: | | | | | | | | | | |
| [1]43*: | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | |
| Castner part--- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| [1]44*: | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | |
| Garlet part---- | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| [1]45*: | | | | | | | | | | |
| Rock outcrop part. | | | | | | | | | | |
| Yawdim part---- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Rippable | Low. |
| Sebud: | | | | | | | | | | |
| 46*, 47*-------- | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| [1]48*: | | | | | | | | | | |
| Sebud part------ | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Cheadle part---- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Shane: | | | | | | | | | | |
| 49, 50---------- | D | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Rippable | Low. |
| [1]51: | | | | | | | | | | |
| Shane part------ | D | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Rippable | Low. |
| Cabba part------ | C | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Rippable | Moderate. |
| Shawa: | | | | | | | | | | |
| 52---------------- | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Tanna: | | | | | | | | | | |
| 53, 54---------- | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Rippable | Low. |
| [1]55: | | | | | | | | | | |
| Tanna part------ | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Rippable | Low. |
| Beenom part----- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| [1]56: | | | | | | | | | | |
| Tanna part------ | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Rippable | Low. |
| Rentsac part---- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Rentsac part---- | D | None-------- | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Potential frost action |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | |
| | | | | | Ft | | | In | | |
| Torrifluvents: [1]57*: | | | | | | | | | | |
| Torrifluvents part | B | Rare | --- | --- | >6.0 | --- | --- | >60 | --- | --- |
| Camborthids part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | --- |
| Turner: | | | | | | | | | | |
| 58, 59 | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| 60 | --- | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Ustifluvents: [1]61*: | | | | | | | | | | |
| Ustifluvents part | --- | Occasional | Brief | Apr-Jun | >6.0 | --- | --- | >60 | --- | --- |
| Fluvaquents part | --- | Occasional | Brief | Apr-Jun | 0-1.0 | Apparent | Feb-Nov | >60 | --- | --- |
| [1]62*: | | | | | | | | | | |
| Ustifluvents part | --- | Rare | --- | --- | >6.0 | --- | --- | >60 | --- | --- |
| Ustochrepts part | --- | None | --- | --- | >6.0 | --- | --- | >60 | --- | --- |
| Wayden: [1]63*: | | | | | | | | | | |
| Wayden part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Rippable | Low. |
| Castner part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Hard | Moderate. |
| Winkler: [1]64*: | | | | | | | | | | |
| Winkler part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Hilger part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Rock outcrop part. | | | | | | | | | | |
| Work: | | | | | | | | | | |
| 65, 66 | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Low. |
| Yamac: | | | | | | | | | | |
| 67, 68, 69, 70 | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Yawdim: [1]71*: | | | | | | | | | | |
| Yawdim part | D | None | --- | --- | >6.0 | --- | --- | 10-20 | Rippable | Low. |
| Lambeth part | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate. |
| Rock outcrop part. | | | | | | | | | | |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 12.--CLASSIFICATION OF THE SOILS

| Soil name | Family or higher taxonomic class |
|---|---|
| Absarokee | Fine, montmorillonitic Typic Argiborolls |
| Absher | Fine, montmorillonitic Borollic Natrargids |
| Amherst | Clayey, montmorillonitic Lithic Argiborolls |
| Assinniboine | Fine-loamy, mixed Aridic Argiborolls |
| Attewan | Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls |
| Beaverell | Loamy-skeletal, mixed Aridic Argiborolls |
| Beenom | Loamy, mixed Lithic Argiborolls |
| Birney | Loamy-skeletal, mixed Borollic Camborthids |
| Bonfri | Fine-loamy, mixed Borollic Haplargids |
| Cabba | Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents |
| Camborthids | Camborthids |
| Castner | Loamy-skeletal, mixed Lithic Haploborolls |
| Cheadle | Loamy-skeletal, mixed Lithic Cryoborolls |
| Fluvaquents | Fluvaquents |
| Garlet | Loamy-skeletal, mixed Typic Cryochrepts |
| Glendive | Coarse-loamy, mixed (calcareous), frigid Ustic Torrifluvents |
| Grail | Fine, montmorillonitic Pachic Argiborolls |
| Harlem | Fine, montmorillonitic (calcareous), frigid Ustic Torrifluvents |
| Havre | Fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents |
| Hilger | Loamy-skeletal, mixed Typic Argiborolls |
| Kobar | Fine, montmorillonitic Borollic Camborthids |
| Lambeth | Fine-silty, mixed (calcareous), frigid Ustic Torriorthents |
| Lardell | Fine-loamy, mixed, frigid Aquollic Salorthids |
| Lohler | Fine, montmorillonitic (calcareous), frigid Typic Ustifluvents |
| Lolo | Loamy-skeletal, mixed Pachic Haploborolls |
| Lonna | Fine-silty, mixed Borollic Camborthids |
| McKenzie | Fine, montmorillonitic (calcareous), frigid Typic Haplaquepts |
| Nesda | Sandy-skeletal, mixed Fluventic Haploborolls |
| Rentsac | Loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents |
| Sebud | Loamy-skeletal, mixed Typic Cryoborolls |
| Shane | Very-fine, montmorillonitic Abruptic Argiborolls |
| Shawa | Fine-loamy, mixed Pachic Haploborolls |
| Sinnigam | Clayey-skeletal, mixed Lithic Argiborolls |
| Tanna | Fine, montmorillonitic Aridic Argiborolls |
| Torrifluvents | Torrifluvents |
| Turner | Fine-loamy over sandy or sandy-skeletal, mixed Typic Argiborolls |
| Ustifluvents | Ustifluvents |
| Ustochrepts | Ustochrepts |
| Wayden | Clayey, montmorillonitic (calcareous), frigid, shallow Typic Ustorthents |
| Winkler | Loamy-skeletal, mixed, frigid Udic Ustochrepts |
| Work | Fine, montmorillonitic Typic Argiborolls |
| Yamac | Fine-loamy, mixed Borollic Camborthids |
| Yawdim | Clayey, montmorillonitic (calcareous), frigid, shallow Ustic Torriorthents |

TABLE 13.--TEMPERATURE AND PRECIPITATION DATA

| Month | Temperature | | | | Total precipitation |
|---|---|---|---|---|---|
| | Mean daily maximum | Mean daily minimum | Monthly highest maximum | Monthly lowest minimum | |
| | Columbus, Montana. Elevation 3,590 feet | | | | |
| January | 36 | 8 | 68 | -36 | .38 |
| February | 41 | 11 | 79 | -45 | .36 |
| March | 47 | 19 | 77 | -29 | .85 |
| April | 60 | 29 | 90 | -16 | 1.50 |
| May | 71 | 39 | 96 | 9 | 2.34 |
| June | 77 | 46 | 102 | 28 | 2.79 |
| July | 89 | 51 | 109 | 34 | .89 |
| August | 88 | 48 | 106 | 31 | .76 |
| September | 77 | 40 | 102 | 21 | 1.23 |
| October | 65 | 31 | 88 | 3 | 1.12 |
| November | 48 | 20 | 76 | -33 | .60 |
| December | 41 | 14 | 71 | -31 | .44 |
| Annual | 62 | 30 | | | 13.26 |
| | Rapelje, Montana. Elevation 4,125 feet | | | | |
| January | 34 | 11 | 70 | -41 | .45 |
| February | 38 | 13 | 72 | -45 | .47 |
| March | 45 | 19 | 80 | -30 | .82 |
| April | 57 | 29 | 88 | -11 | 1.18 |
| May | 66 | 37 | 98 | - 1 | 2.15 |
| June | 75 | 45 | 106 | 24 | 2.72 |
| July | 85 | 51 | 108 | 30 | 1.02 |
| August | 84 | 49 | 105 | 26 | 1.06 |
| September | 72 | 41 | 103 | 10 | 1.12 |
| October | 61 | 32 | 91 | -15 | 1.00 |
| November | 46 | 23 | 79 | -34 | .58 |
| December | 38 | 16 | 69 | -39 | .38 |
| Annual | 58 | 31 | | | 12.95 |

TABLE 13.--TEMPERATURE AND PRECIPITATION DATA--Continued

| Month | Temperature | | | | Total precipitation |
|---|---|---|---|---|---|
| | Mean daily maximum | Mean daily minimum | Monthly highest maximum | Monthly lowest minimum | |
| | Mystic Lake, Montana. Elevation 6,558 feet | | | | |
| January | 32 | 14 | 60 | -35 | 1.25 |
| February | 34 | 15 | 62 | -37 | 1.16 |
| March | 39 | 19 | 62 | -23 | 2.34 |
| April | 49 | 28 | 80 | -13 | 2.84 |
| May | 58 | 36 | 83 | 6 | 3.24 |
| June | 65 | 43 | 87 | 21 | 3.39 |
| July | 75 | 51 | 94 | 30 | 2.00 |
| August | 73 | 49 | 92 | 31 | 1.77 |
| September | 64 | 41 | 88 | 5 | 2.01 |
| October | 55 | 34 | 79 | - 7 | 1.53 |
| November | 41 | 24 | 68 | -24 | 1.37 |
| December | 35 | 19 | 62 | -35 | 1.12 |
| Annual | 52 | 31 | | | 24.02 |

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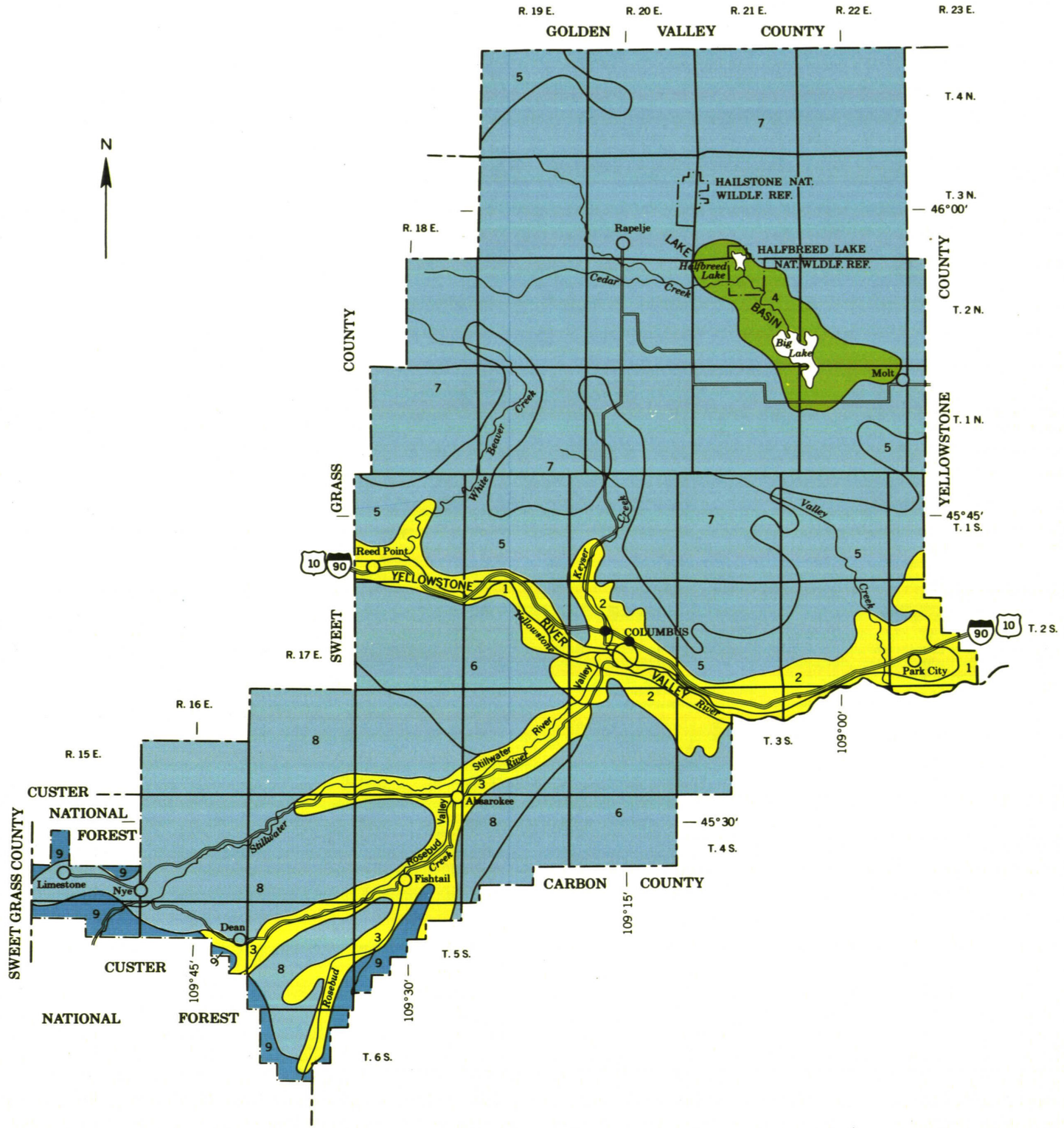



## MAP UNITS*

DEEP, NEARLY LEVEL TO MODERATELY SLOPING, WELL DRAINED SOILS ON LOW TERRACES, ALLUVIAL FANS, AND FLOOD PLAINS

1 — Havre-Harlem-Glendive: Deep, nearly level or gently sloping, well drained loams, clay loams, and fine sandy loams that formed in alluvium; on flood plains, alluvial fans, and terraces

2 — Yamac-Kobar-Attewan: Deep, nearly level to moderately sloping, well drained loams and clay loams that formed in alluvium; on fans and terraces

3 — Lolo-Shawa-Nesda: Deep, nearly level to moderately sloping, well drained gravelly loams and silty clay loams that formed in alluvium; on flood plains, terraces, and alluvial fans

DEEP, NEARLY LEVEL, SOMEWHAT POORLY DRAINED AND POORLY DRAINED, SALINE SOILS IN CLOSED BASINS

4 — Lardell-McKenzie: Deep, nearly level, somewhat poorly drained to poorly drained clay loams and clays that formed in alluvium; in closed basins and on flood plains and terraces

SHALLOW TO DEEP, GENTLY SLOPING TO VERY STEEP, WELL DRAINED SOILS ON SANDSTONE AND SHALE UPLANDS

5 — Yawdim-Lambeth-Birney: Shallow to deep, moderately steep to very steep, well drained clay loams, silt loams, and channery loams that formed in material weathered from shale; on uplands

6 — Absarokee-Sinnigam-Castner: Moderately deep and shallow, gently sloping to steep, well drained clay loams and loams that formed in material weathered from shale and sandstone; on uplands

7 — Tanna-Rentsac-Bonfri: Moderately deep or shallow, gently sloping to moderately steep, well drained clay loams and loams that formed in material weathered from sandstone and shale; on uplands

8 — Hilger-Castner-Turner: Deep to shallow, gently sloping to steep, well drained cobbly sandy loams, loams, and clay loams that formed in material weathered from sandstone and shale and in gravelly alluvium; on hillsides, ridgetops, and broad divides and terraces on uplands

DEEP, MODERATELY SLOPING TO VERY STEEP, WELL DRAINED SOILS ON MOUNTAINS

9 — Sebud-Garlet-Rock outcrop: Rock outcrop and deep, moderately sloping to very steep, well drained stony loams and gravelly sandy loams that formed in material weathered from sandstone and igneous rock and in glacial till; on foothills, mountainsides, and ridgetops

*Terms for texture in the descriptive headings of the map units apply to the surface layer of the major soils.

Compiled 1979

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MONTANA AGRICULTURAL EXPERIMENT STATION

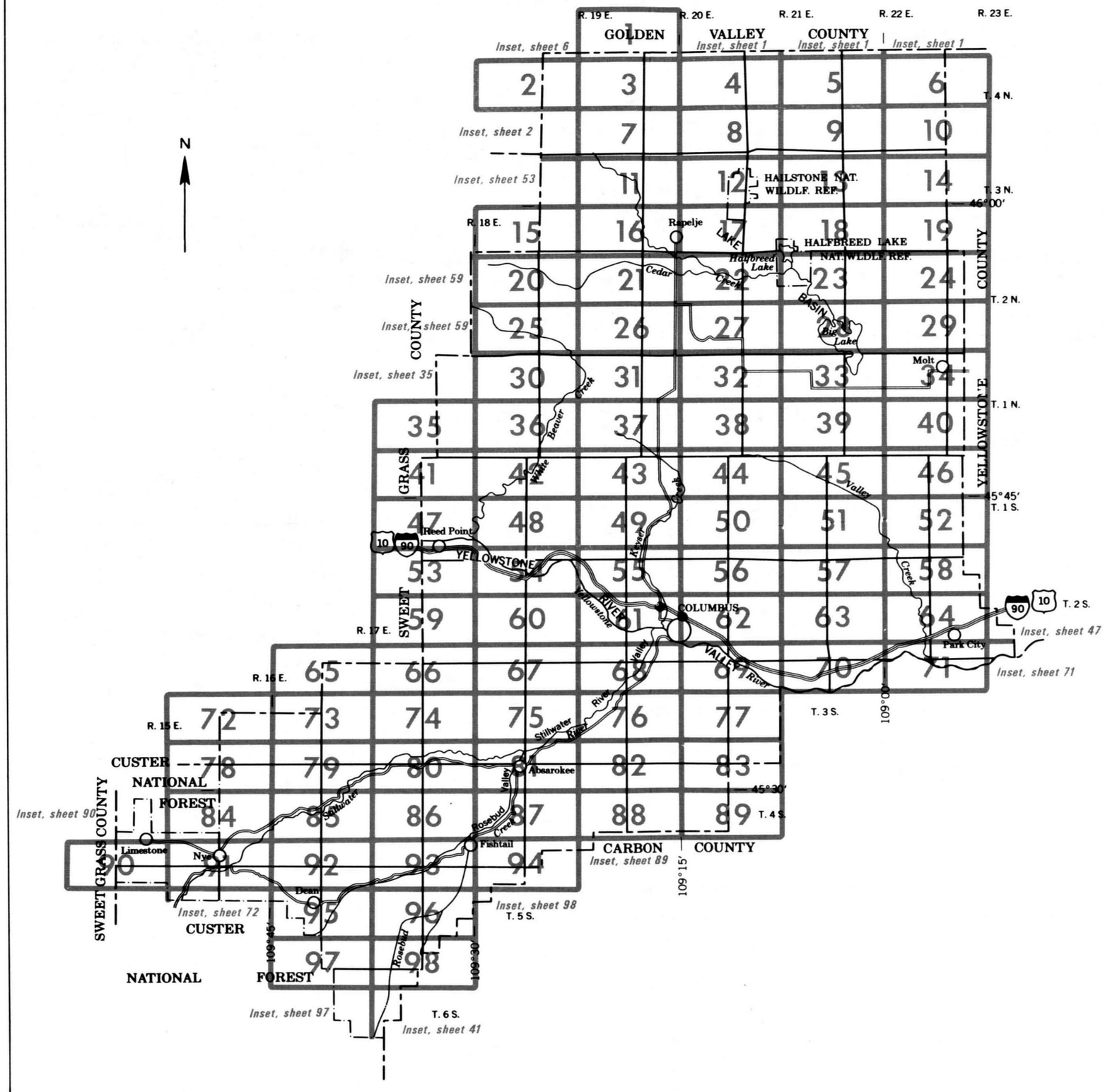
# GENERAL SOIL MAP

## STILLWATER COUNTY AREA, MONTANA

Scale 1: 443,520

1 0 1 2 3 4 5 6 7 MILES

*Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.*




# INDEX TO MAP SHEETS

## STILLWATER COUNTY AREA, MONTANA

Scale 1: 443,520

1 0 1 2 3 4 5 6 7 MILES

## SOIL LEGEND

| SYMBOL | NAME |
|---|---|
| 1 | Absarokee clay loam, 2 to 8 percent slopes |
| 2 | Absarokee clay loam, 8 to 15 percent slopes |
| 3 | Absarokee-Sinnigam clay loams, 2 to 8 percent slopes |
| 4 | Absarokee-Sinnigam clay loams, 8 to 15 percent slopes |
| 5 | Absarokee-Sinnigam complex, 15 to 50 percent slopes* |
| 6 | Absarokee-Amherst-Castner complex, 4 to 8 percent slopes |
| 7 | Absher silty clay loam, 0 to 6 percent slopes |
| 8 | Amherst-Absarokee-Castner complex, 8 to 15 percent slopes |
| 9 | Assinniboine fine sandy loam, 2 to 15 percent slopes |
| 10 | Assinniboine-Rentsac complex, 6 to 12 percent slopes |
| 11 | Attewan loam, 0 to 4 percent slopes |
| 12 | Attewan loam, seeped, 0 to 4 percent slopes |
| 13 | Attewan-Beaverell gravelly loams, 0 to 4 percent slopes |
| 14 | Beaverell very gravelly loam, 0 to 8 percent slopes |
| 15 | Birney-Yawdim-Rock outcrop association, steep* |
| 16 | Bonfri-Lambeth complex, 2 to 8 percent slopes |
| 17 | Bonfri-Lambeth complex, 8 to 15 percent slopes |
| 18 | Garlet-Sebud association, very steep* |
| 19 | Glendive fine sandy loam, 0 to 4 percent slopes |
| 20 | Glendive fine sandy loam, occasionally flooded |
| 21 | Grail clay loam, 0 to 4 percent slopes |
| 22 | Grail clay loam, 4 to 8 percent slopes |
| 23 | Harlem clay loam, 0 to 2 percent slopes |
| 24 | Harlem clay loam, occasionally flooded |
| 25 | Havre loam, 0 to 2 percent slopes |
| 26 | Havre loam, 2 to 4 percent slopes |
| 27 | Havre loam, occasionally flooded |
| 28 | Hilger-Castner-Rock outcrop complex, 25 to 60 percent slopes* |
| 29 | Kobar clay loam, 0 to 4 percent slopes |
| 30 | Kobar clay loam, 4 to 8 percent slopes |
| 31 | Lambeth silt loam, 2 to 15 percent slopes |
| 32 | Lambeth-Rentsac complex, 4 to 15 percent slopes |
| 33 | Lambeth-Yawdim complex, 4 to 15 percent slopes |
| 34 | Lardell clay loam, 0 to 2 percent slopes* |
| 35 | Lohler clay loam, 0 to 2 percent slopes |
| 36 | Lohler clay loam, 2 to 4 percent slopes |
| 37 | Lolo complex, 0 to 4 percent slopes |
| 38 | Lolo and Nesda soils, flooded* |
| 39 | Lonna silt loam, 2 to 8 percent slopes |
| 40 | Lonna silt loam, 8 to 15 percent slopes |
| 41 | McKenzie clay, saline* |
| 42 | Rentsac loam, 15 to 30 percent slopes |
| 43 | Rock outcrop-Castner association, steep* |
| 44 | Rock outcrop-Garlet association, very steep* |
| 45 | Rock outcrop-Yawdim association, steep* |
| 46 | Sebud stony loam, 4 to 25 percent slopes* |
| 47 | Sebud stony loam, 25 to 50 percent slopes* |
| 48 | Sebud-Cheadle association, very steep* |
| 49 | Shane clay loam, 4 to 8 percent slopes |
| 50 | Shane clay loam, 8 to 15 percent slopes |
| 51 | Shane-Cabba clay loams, 4 to 10 percent slopes |
| 52 | Shawa silty clay loam, 0 to 8 percent slopes |
| 53 | Tanna clay loam, 2 to 8 percent slopes |
| 54 | Tanna clay loam, 8 to 15 percent slopes |
| 55 | Tanna-Beenom complex, 4 to 8 percent slopes |
| 56 | Tanna-Rentsac complex, 4 to 15 percent slopes |
| 57 | Torrifluvents-Camborthids association, gently sloping* |
| 58 | Turner clay loam, 2 to 4 percent slopes |
| 59 | Turner clay loam, 4 to 8 percent slopes |
| 60 | Turner stony clay loam, 4 to 15 percent slopes |
| 61 | Ustifluvents-Fluvaquents association, flooded* |
| 62 | Ustifluvents-Ustochrepts association, gently sloping* |
| 63 | Wayden-Castner association, steep* |
| 64 | Winkler-Hilger-Rock outcrop association, steep* |
| 65 | Work loam, 4 to 8 percent slopes |
| 66 | Work loam, 8 to 15 percent slopes |
| 67 | Yamac loam, 0 to 2 percent slopes |
| 68 | Yamac loam, 2 to 4 percent slopes |
| 69 | Yamac loam, 4 to 8 percent slopes |
| 70 | Yamac loam, 8 to 15 percent slopes |
| 71 | Yawdim-Lambeth-Rock outcrop association, steep* |

*Broadly defined unit

# CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

## CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (416)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; W)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

## WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; W)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

## SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (SvE 107)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot (0)
- Borrow pit (B.P.)
- Glacial till

STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 1

1

N

109°00′

46°08′

LIMIT OF SOIL SURVEY

GOLDEN STILLWATER VALLEY COUNTY

R. 22 E.

YELLOWSTONE CO

2 155 000 FEET

778 000 FEET

(Joins lower right)

776 000 FEET

2 130 000 FEET

INSET C

(Joins sheet 6)

46°07′30″

108°52′30″

109°07′30″

46°08′

GOLDEN STILLWATER VALLEY COUNTY

R. 21 E. R. 22 E.

2 125 000 FEET

778 000 FEET

(Joins lower right)

776 000 FEET

2 100 000 FEET

(Joins sheet 5)

INSET B

(Joins sheet 5)

(Joins upper left)

46°07′30″

109°00′

109°15′

46°08′

GOLDEN STILLWATER VALLEY COUNTY

R. 20 E. R. 21 E.

2 095 000 FEET

778000 FEET

(Joins lower right)

775 000 FEET

2 065 000 FEET

INSET A

(Joins sheet 4)

T. 4 N.

(Joins upper left)

46°07′30″

109°07′30″

109°22′30″

46° 08′

GOLDEN STILLWATER VALLEY COUNTY

R. 19 E. R. 20 E.

2 060 000 FEET

777000 FEET

(Joins inset sheet 6)

775 000 FEET

2 035 000 FEET

(Joins sheet 3)

T. 4 N.

(Joins upper left)

46°07′30″

109°15′

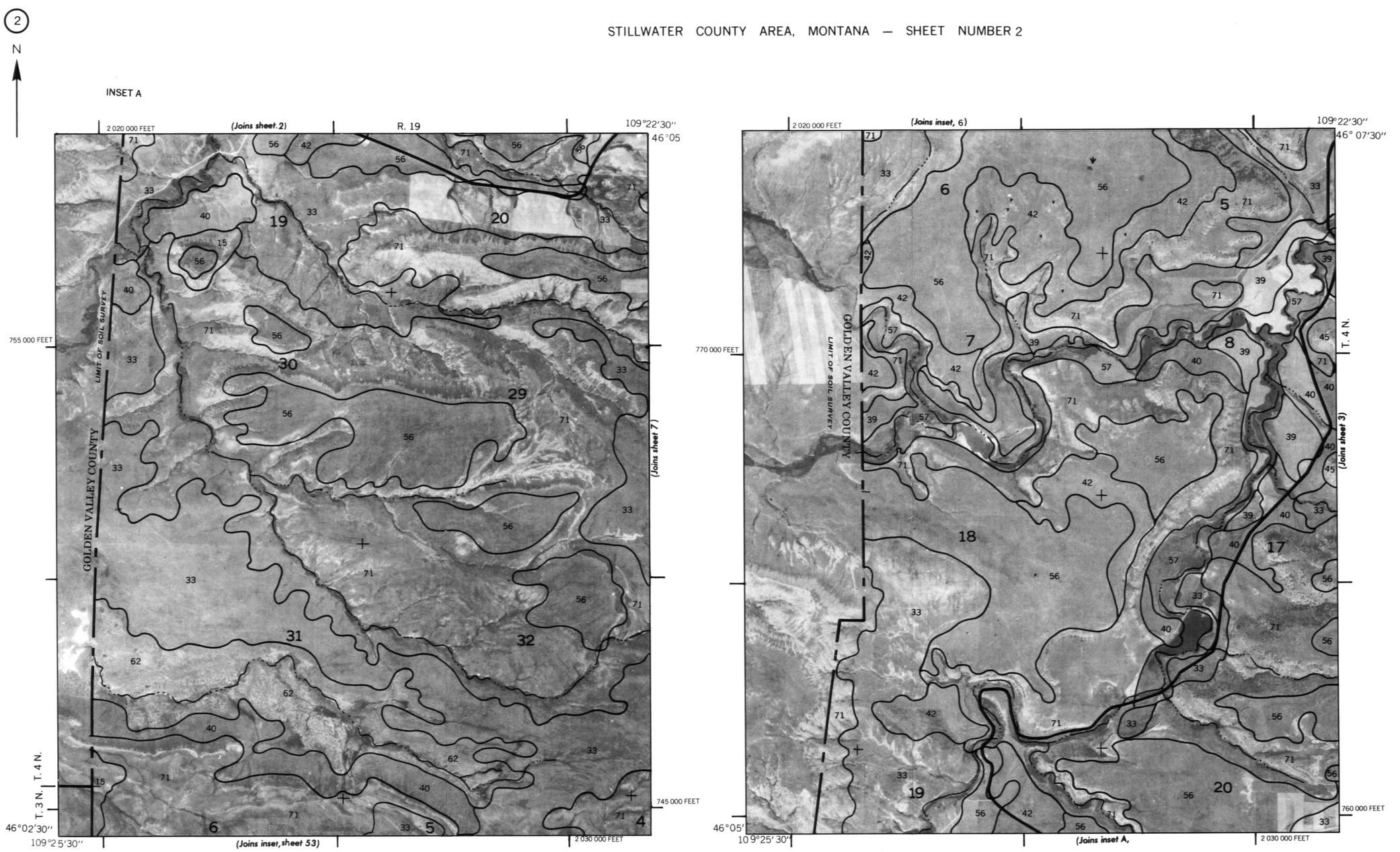
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

STILLWATER COUNTY AREA, MONTANA NO. 1

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.




1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 2

N

109°22′30″

46°07′30″

R. 19 E. R. 20 E.

(Joins sheet 1)

2 060 000 FEET

770 000 FEET

(Joins sheet 2)

(Joins sheet 4)

T. 2 N.

760 000 FEET

46° 05′

109°15′

(Joins sheet 7)

2 035 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 3

STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 4

1 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

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STILLWATER COUNTY AREA, MONTANA NO. 4

N

109°07′30″

46°07′30″

R. 21 E. | R. 22 E.

(Joins inset B, sheet 1)

2 125 000 FEET

775 000 FEET

T. 4 N.

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 9)

760 000 FEET

2 100 000 FEET

46°05′

109°00′

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

STILLWATER COUNTY AREA, MONTANA NO. 5

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N

775 000 FEET

2 130 000 FEET

(Joins inset, sheet 1)

R. 22 E.

108°52′30″

46°07′30″

LIMIT OF SOIL SURVEY

STILLWATER COUNTY

YELLOWSTONE COUNTY

T. 4 N.

765 000 FEET

777 000 FEET

LIMIT OF SOIL SURVEY

GOLDEN VALLEY COUNTY

LIMIT OF SOIL SURVEY

STILLWATER CO

GOLDEN VALLEY CO

STILLWATER CO

109°22′30″

46°08′

46°07′30″

775 000 FEET

109°25′

INSET A

(Joins sheet 2)

2 030 000 FEET

(Joins sheet 5)

46°05′

109°00′

(Joins sheet 10)

2 155 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 6

N

109° 22′30″

46° 05′

R. 19 E. | R. 20 E.

(Joins sheet 3)

2 060 000 FEET

(Joins inset, sheet 2)

755 000 FEET

(Joins sheet 8)

750 000 FEET

T. 3 N., T. 4 N.

2 035 000 FEET

(Joins sheet 11)

46°02′30″

109° 15′

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 7

STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 8

8

N

R. 20 E. | R. 21 E.

109°07′30″

46°05′

2 065 000 FEET

(Joins sheet 4)

755 000 FEET

(Joins sheet 7)

(Joins sheet 9)

T. 4 N.

T. 3 N.

46°02′30″

109°15′

(Joins sheet 12)

745 000 FEET

2 095 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 8

N

109°07'30"

46° 05

R. 21 E. | R. 22 E.

(Joins sheet 5)

2 125 000 FEET

755 000 FEET

T. 3 N. | T. 4 N.

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 13)

2 100 000 FEET

745 000 FEET

46°02'30"

109°00'

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 9

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 10

N

2 130 000 FEET

(Joins sheet 6)

R. 22 E.

R. 23 E.

108°52'30"

46°05'

755 000 FEET

750 000 FEET

(Joins sheet 9)

46° 02'30"

109°00'

(Joins sheet 14)

2 155 000 FEET

LIMIT OF SOIL SURVEY

STILLWATER COUNTY

YELLOWSTONE COUNTY

T. 4 N.

T. 3 N.

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

STILLWATER COUNTY AREA, MONTANA NO. 10

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

N

109°22′30″

46°02′30″

R. 19 E. | R. 20 E.

(Joins sheet 7)

2 060 000 FEET

740 000 FEET

T. 3 N. | T. 4 N.

(Joins sheet 53 - inset A, ).

2 035 000 FEET

(Joins sheet 16)

(Joins sheet 12)

730 000 FEET

46°00′

109°15′

Six Shooter Creek

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

N

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 12

2 065 000 FEET

(Joins sheet 8)

R. 20 E.

R. 21 E.

109°07'30"

46°02'30"

740 000 FEET

(Joins sheet 11)

T. 3 N.

(Joins sheet 13)

730 000 FEET

46°00'

109°15'

(Joins sheet 17)

2 095 000 FEET

HAILSTONE NATIONAL WILDLIFE REFUGE

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

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STILLWATER COUNTY AREA, MONTANA NO. 12

N

109°07′30″
46°02′30″

R. 21 E. R. 22 E.

(Joins sheet9)

2 125 000 FEET

740 000 FEET

T. 3 N.

(Joins sheet 12)

(Joins sheet 14)

730 000 FEET

2 100 000 FEET

(Joins sheet 18)

46°00′
109°00′

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 13

14

N

2 130 000 FEET

(Joins sheet 10)

R. 22 E.

R. 23 E.

108°52'30"

46°02'30"

740 000 FEET

(Joins sheet 13)

T. 3 N.

COUNTY

STILLWATER

COUNTY

YELLOWSTONE

SOIL SURVEY OF LIMIT

730 000 FEET

46°00'

109°00'

(Joins sheet 19)

2 155 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 14

N

109°30′
46°00′

R. 18 E.

R. 19 E.

(Joins sheet inset, 53)

2 030 000 FEET

725 000 FEET

(Joins sheet 16)

T. 2 N. | T. 3 N.

715 000 FEET

2 000 000 FEET

LIMIT OF SOIL SURVEY

SWEETGRASS COUNTY

STILLWATER COUNTY

Middle Creek

Cummin Creek

(Joins sheet 20)

45°57′30″
109°22′30″

Scale 1:24000

1 Mile 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

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5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 15

N

2 035 000 FEET

(Joins sheet 11)

R. 19 E. | R. 20 E.

109°15′

46°00′

725 000 FEET

(Joins sheet 15)

(Joins sheet 17)

T. 3 N.

T. 2 N.

45°57 30″

109°22′30″

(Joins sheet 21)

2 060 000 FEET

715 000 FEET

T. 2 N.

Cummin Creek

Middle Creek

Six Shooter Creek

Mills Creek

RAPELIE

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 16

N

109°15′

46°00′

R. 20 E. | R. 21 E.

(Joins sheet 12)

2 095 000 FEET

725 000 FEET

T. 3 N.

T. 2 N.

715 000 FEET

2 065 000 FEET

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 22)

45°57′30″

109°07′30″

HAILSTONE NATIONAL WILDLIFE REFUGE

HALFBREED LAKE NATIONAL WILDLIFE REFUGE

NORTHERN PACIFIC

Dallmann Lake

water

21 22 23 24 19 20 21 28 27 26 25 30 29 28 33 34 35 36 31 32 33 5

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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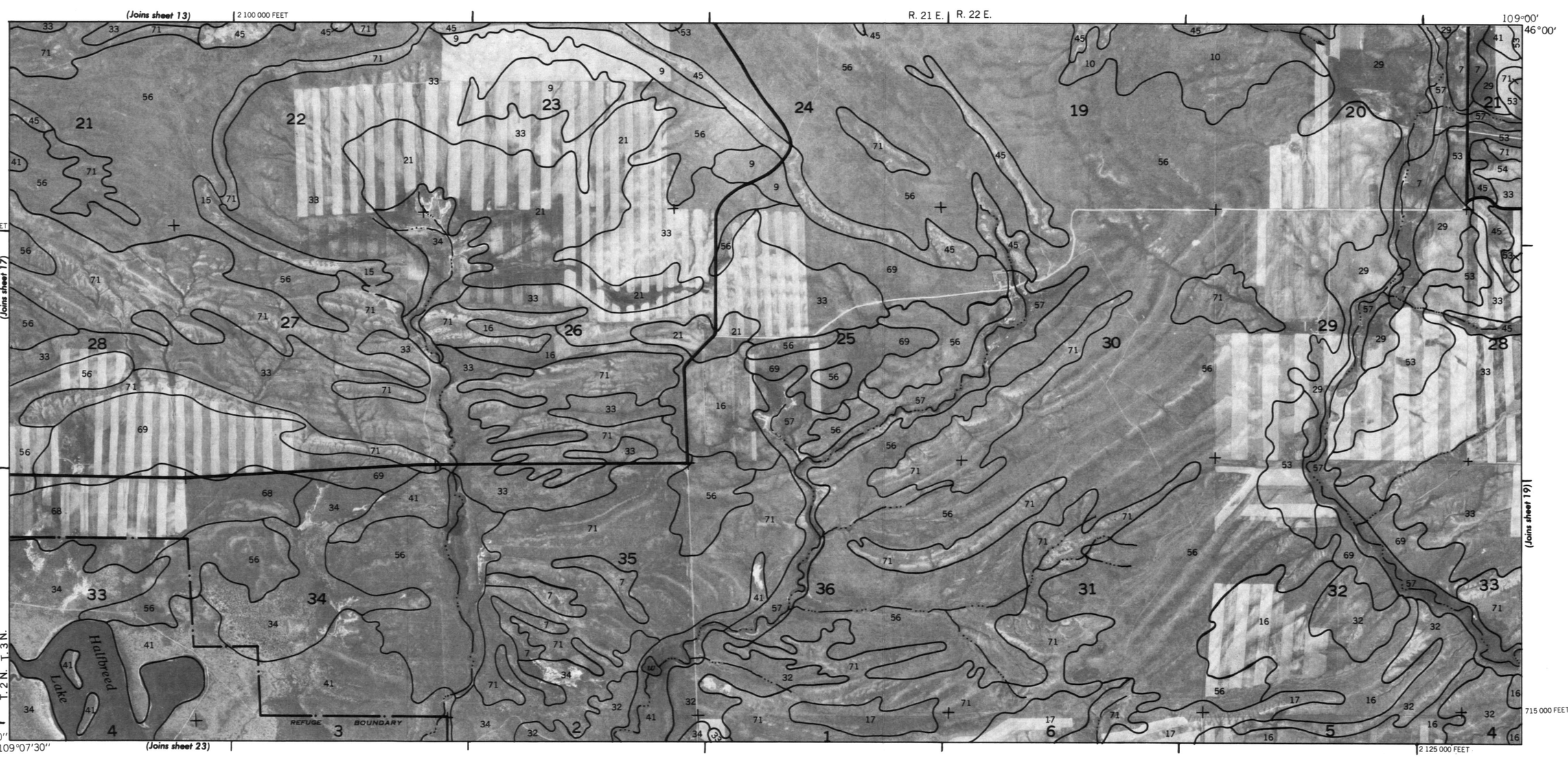
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 17




1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 18

N

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



109°00′
46°00′
(Joins sheet 14)
R. 22 E.
R. 23 E.
2 155 000 FEET
725 000 FEET
T. 2 N.
T. 3 N.
(Joins sheet 18)
2 130 000 FEET
(Joins sheet 24)
715 000 FEET
45°57′30″
108°52′30″
57 South
57 Comanche Creek
Lost Creek
STILLWATER COUNTY
YELLOWSTONE COUNTY
LIMIT OF SOIL SURVEY

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

N

2 000 000 FEET

(Joins sheet 15)

R. 18 E. R. 19 E.

109°22′30″

45° 57′ 30″

710 000 FEET

T. 2 N.

(Joins sheet 59, INSET A)

(Joins sheet 21)

700 000 FEET

45° 55′

109° 30′

(Joins sheet 25)

2 030 000 FEET

Cummin Creek

North Fork Cedar Creek

South Fork Cedar Creek

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

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STILLWATER COUNTY AREA, MONTANA NO. 20

N

109°22′30″

45°57′30″

2 035 000 FEET

R. 19 E. | R. 20 E.

(Joins sheet 16)

2 060 000 FEET

710 000 FEET

T. 3 N.

(Joins sheet 20)

(Joins sheet 22)

700 000 FEET

2 035 000 FEET

(Joins sheet 26)

45° 55′

109° 15′

Lake Basin

Middle Creek

Cedar Creek

Creek

Gurney Creek

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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STILLWATER COUNTY AREA, MONTANA NO. 21

N

2 065 000 FEET

(Joins sheet 17)

R. 20 E. | R. 21 E.

109° 07′30″

45° 57′30″

710 000 FEET

T. 2 N.

(Joins sheet 21)

(Joins sheet 23)

700 000 FEET

45°55′

109°15′

(Joins sheet 27)

2 095 000 FEET

Six Shooter Creek

Middle Creek

Gurney Creek

Twin Buttes

Cedar Creek

water

water

REFUGE

WILDLIFE

NATIONAL

LAKE

HALFBREED

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 22

N

109°07'30"
45°57'30"

R. 21 E. | R. 22 E.

(Joins sheet 18)

2 125 000 FEET

710 000 FEET

T. 2 N.

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 28)

700 000 FEET

2 100 000 FEET

45°55'
109°00'

Halfbreed Lake

Halfbreed Lake Wildlife Refuge

Dry Lake

Cedar Creek

Lost Creek

BURLINGTON NORTHERN REFUGE BOUNDARY

int

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 23

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 24

STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 25

25

N

R. 18 E. R. 19 E.

109°30′

45°55′

(Joins sheet 20)

2 030 000 FEET

695 000 FEET

(Joins sheet 26)

T. 2 N.

(Joins inset B, sheet 59)

685 000 FEET

2 000 000 FEET

45°52′30″

109°22′30″

(Joins sheet 30)

East White Beaver Creek

Camp Creek

East White Beaver Creek

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 25

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 26

N

2 035 000 FEET

(Joins sheet 21)

R. 19 E.

R. 20 E.

109°15′

45°55′

695 000 FEET

(Joins sheet 25)

T. 2 N.

(Joins sheet 27)

685 000 FEET

45°52′30″

109°22′30″

(Joins sheet 31)

2 060 000 FEET

Gurney Creek

21 22 23 24 19 20 21

28 27 26 25 30 29 28

33 34 35 36 31 32 33

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 26

N

109°15′

45° 55′

R. 20 E. | R. 21 E.

(Joins sheet 22)

2 095 000 FEET

695 000 FEET

T. 2 N.

(Joins sheet 26)

(Joins sheet 28)

685 000 FEET

2 065 000 FEET

(Joins sheet 32)

45°52′30″

109°07′30″

Grove Creek

Creek

water

water

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies. 5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 28

N

R. 21 E | R. 22 E.

(Joins sheet 23)

2 125 000 FEET

109°00′

45°55′

T. 2 N.

(Joins sheet 29)

695 000 FEET

(Joins sheet 27)

Cedar Creek

BURLINGTON NORTHERN

Big Lake

int

685 000 FEET

45°52′30″

109°07′30″

2 100 000 FEET

(Joins sheet 33)

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 28

N

109°00′

45°55′

R. 22 E. R. 23 E.

(Joins sheet 24)

2 155 000 FEET

695 000 FEET

T. 2 N.

(Joins sheet 28)

685 000 FEET

2 130 000 FEET

45°52′30″

108°52′30″

(Joins sheet 34)

STILLWATER COUNTY — YELLOWSTONE COUNTY

LIMIT OF SOIL SURVEY

BURLINGTON NORTHERN

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

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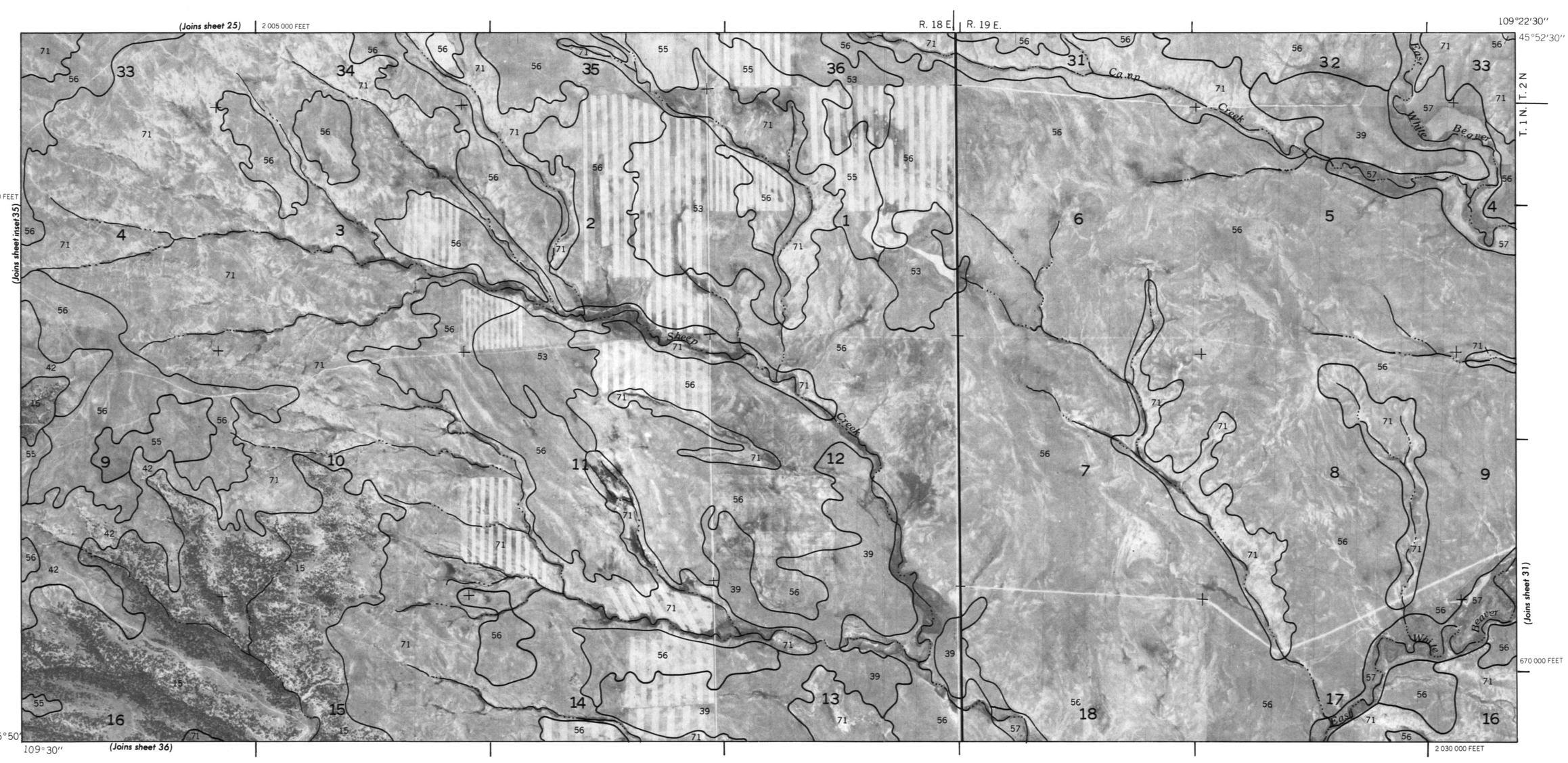
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 29

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 30

N




1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 30

N

109°22′30″
45°52′30″

R. 19 E. | R. 20 E.

(Joins sheet 26) 2 060 000 FEET

T. 1 N. | T. 2 N.

680 000 FEET

(Joins sheet 32)

(Joins sheet 30)

670 000 FEET

2 035 000 FEET

(Joins sheet 37)

45°50′
109°15′

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 32

N

2 065 000 FEET

(Joins sheet 27)

R. 20 E. | R. 21 E.

109°07′30″

45°52′30″

T. 1 N. | T. 2 N.

680 000 FEET

(Joins sheet 31)

(Joins sheet 33)

670 000 FEET

45°50′

109°15′

(Joins sheet 38)

2 095 000 FEET

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 32

N

109°07′30″
45°52′30″

R. 21 E. | R. 22 E.

T. 2 N.
T. 1 N.

(Joins sheet 28)

2 125 000 FEET

680 000 FEET

(Joins sheet 34)

(Joins sheet 32)

670 000 FEET

2 100 000 FEET

(Joins sheet 39)

45°50′
109°00′

Big Lake

water

Hunter Lake

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

N

2 130 000 FEET

(Joins sheet 29)

R. 22 E.

R. 23 E.

108°52′30″

45°52′30″

T. 1 N. | T. 2 N.

680 000 FEET

(Joins sheet 33)

670 000 FEET

45°50′

109°00′

(Joins sheet 40)

2 155 000 FEET

BURLINGTON

NORTHERN

MOLT

BASIN

LAKE

Creek

Canyon

STILLWATER COUNTY

YELLOWSTONE COUNTY

SOIL SURVEY OF LIMIT

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

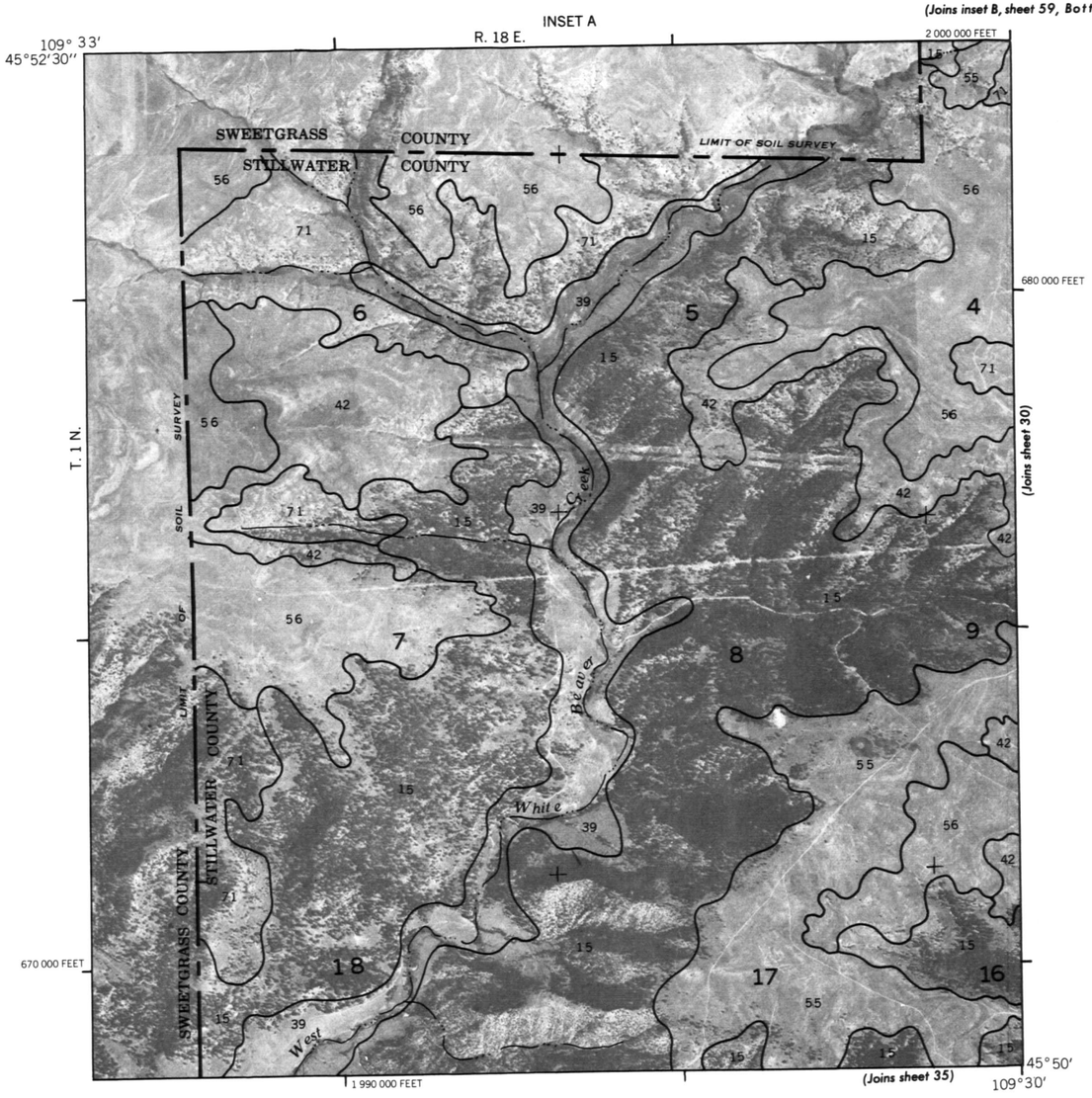
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

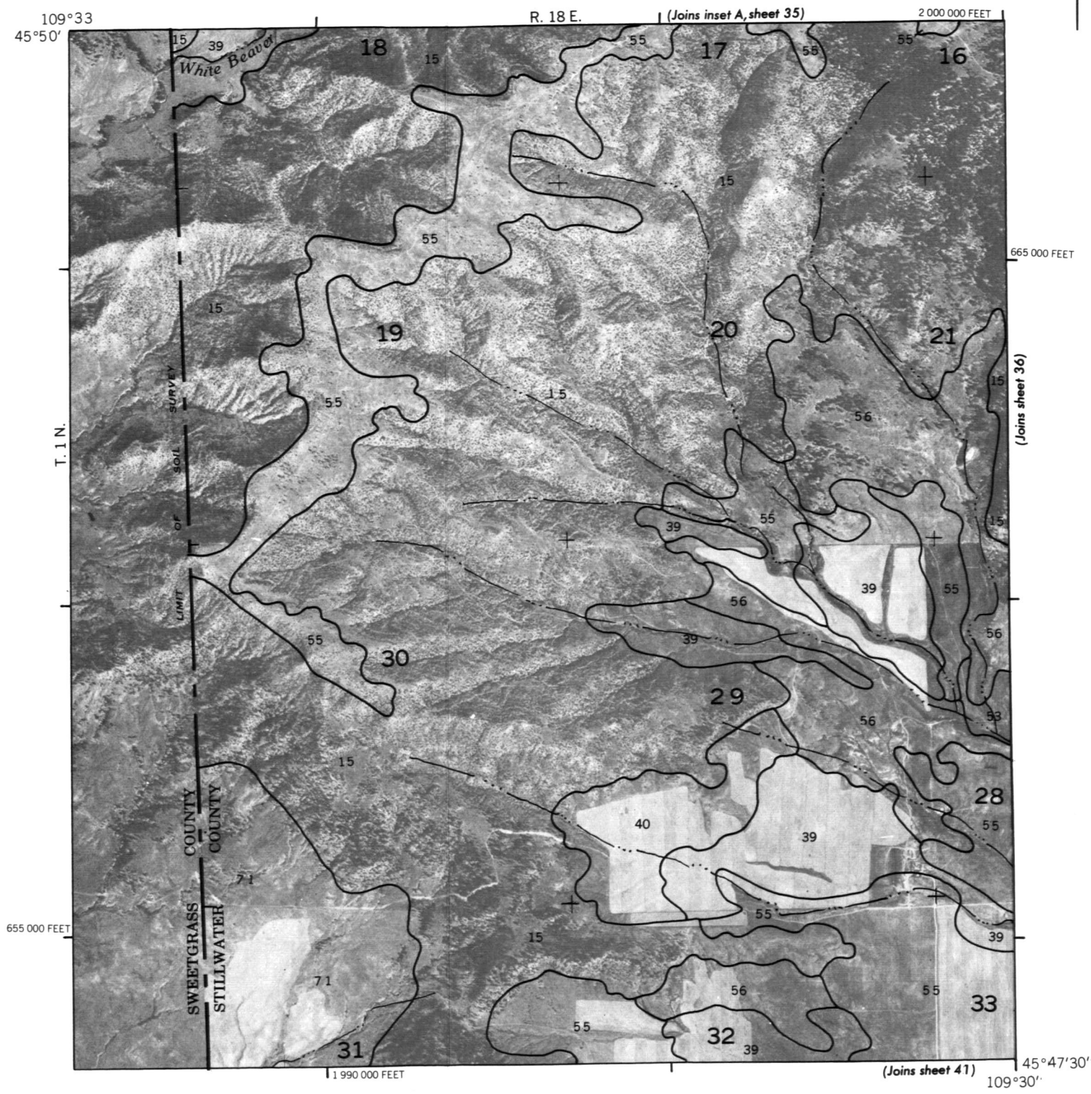
This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography or orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 34

N

INSET A




1 ¾ ½ ¼ 0 1 2 Miles

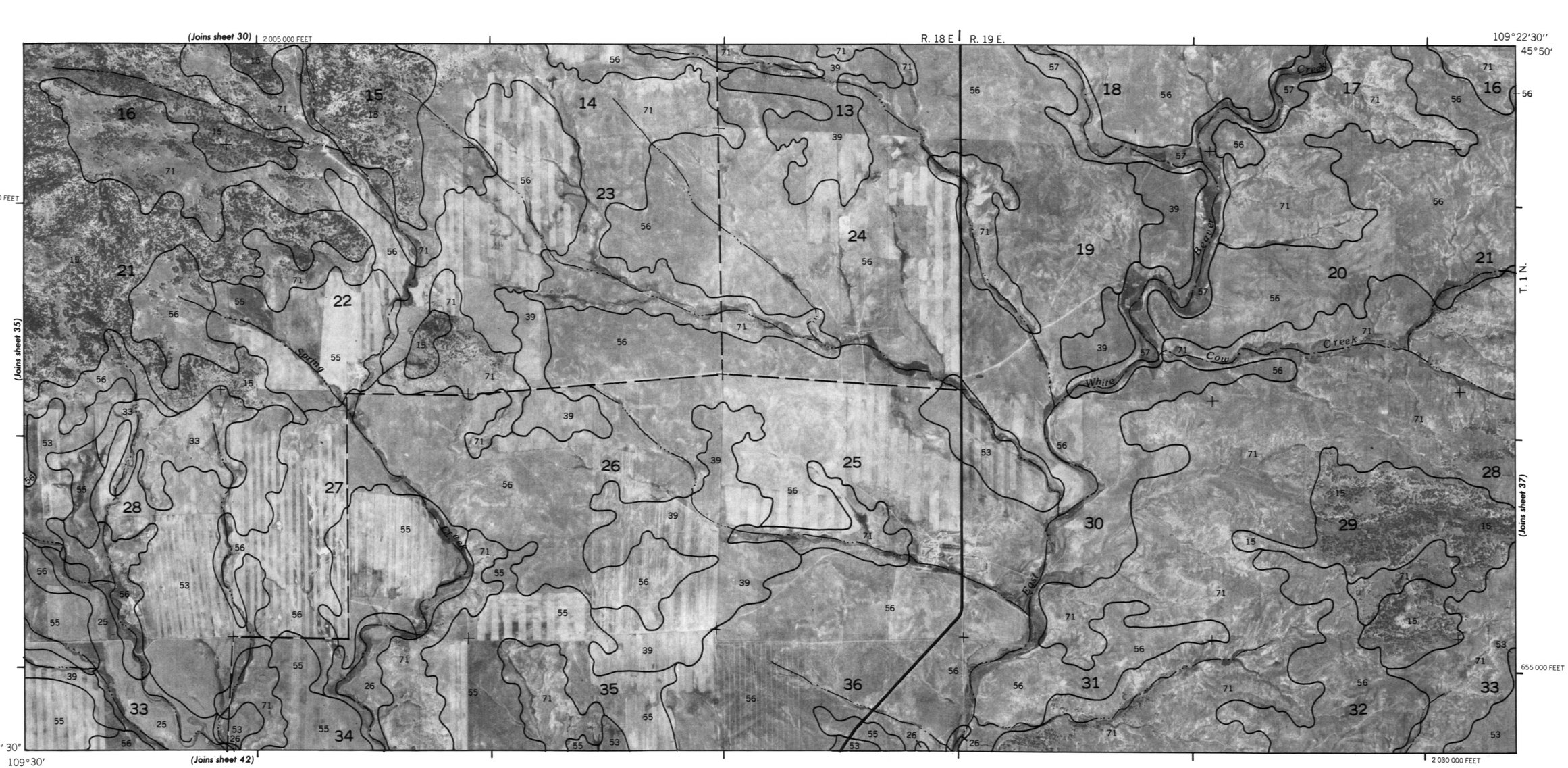
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 35

N




1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 36

N

109°22′30″
45°50′

R. 19 E. | R. 20 E.

(Joins sheet 31) 2 060 000 FEET

665 000 FEET

T. 1 N.

(Joins sheet 36)

655 000 FEET

2 035 000 FEET

(Joins sheet 43)

45°47′30″
109°15′

(Joins sheet 38)

Cow Creek

Creek

Keyser Creek

Cottonwood Creek

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 37

38

N

2 065 000 FEET

(Joins sheet 32)

R. 20 E.

R. 21 E.

109°07′30″

45°50′

665 000 FEET

T. 1 N.

(Joins sheet 37)

(Joins sheet 39)

655 000 FEET

45°47′30″

109°15′

(Joins sheet 44)

2 095 000 FEET

Greenwood Creek

Greenwood Creek

Greenwood Creek

5 000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

STILLWATER COUNTY AREA, MONTANA NO. 38

N

109°07′30″
45°50′

R. 21 E. | R. 22 E.

(Joins sheet 33) | 2 125 000 FEET

665 000 FEET

(Joins sheet 40)

T. 1 N.

(Joins sheet 38)

655 000 FEET

2 100 000 FEET

(Joins sheet 45)

45°47′30″
109°00′

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

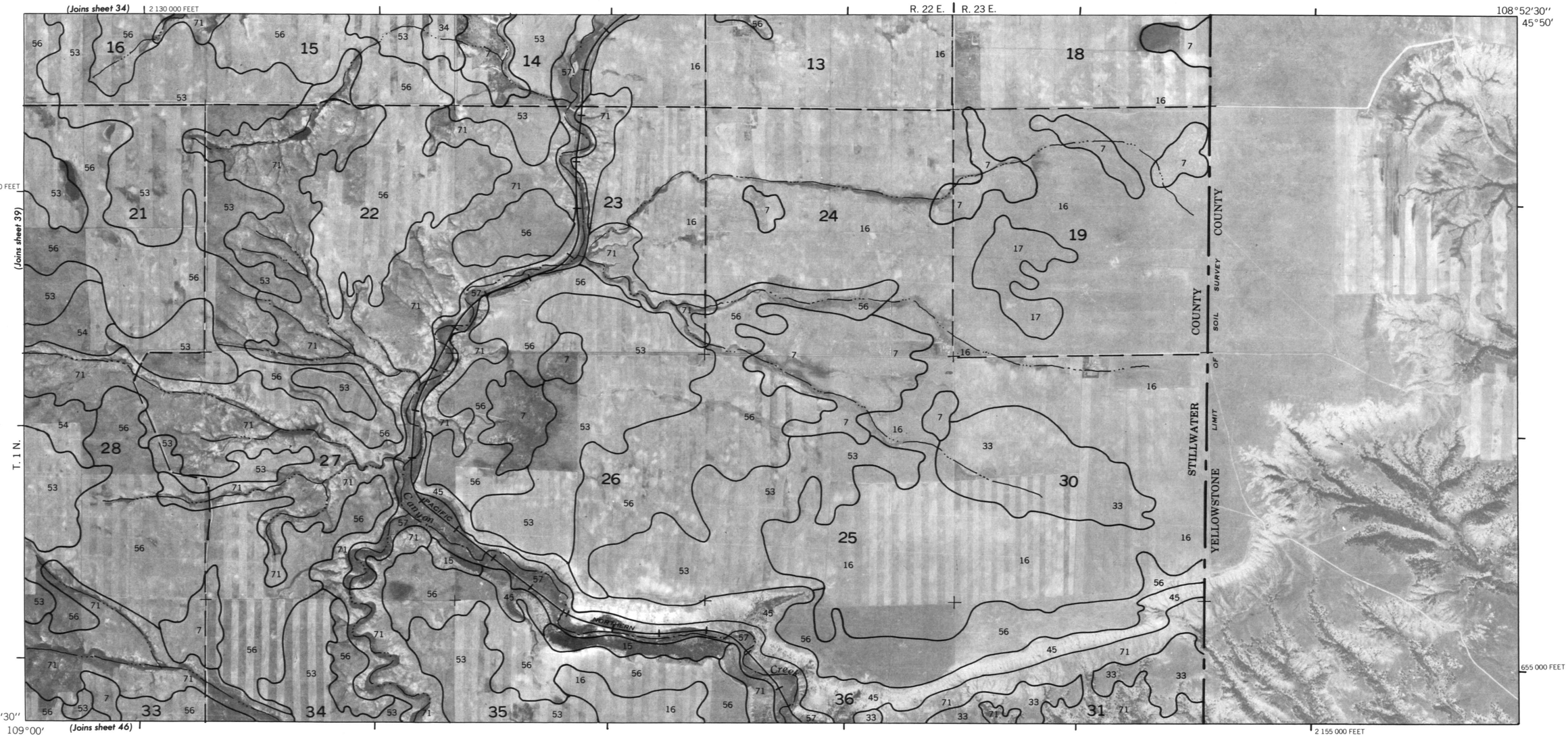
5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 39

N

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 40




1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

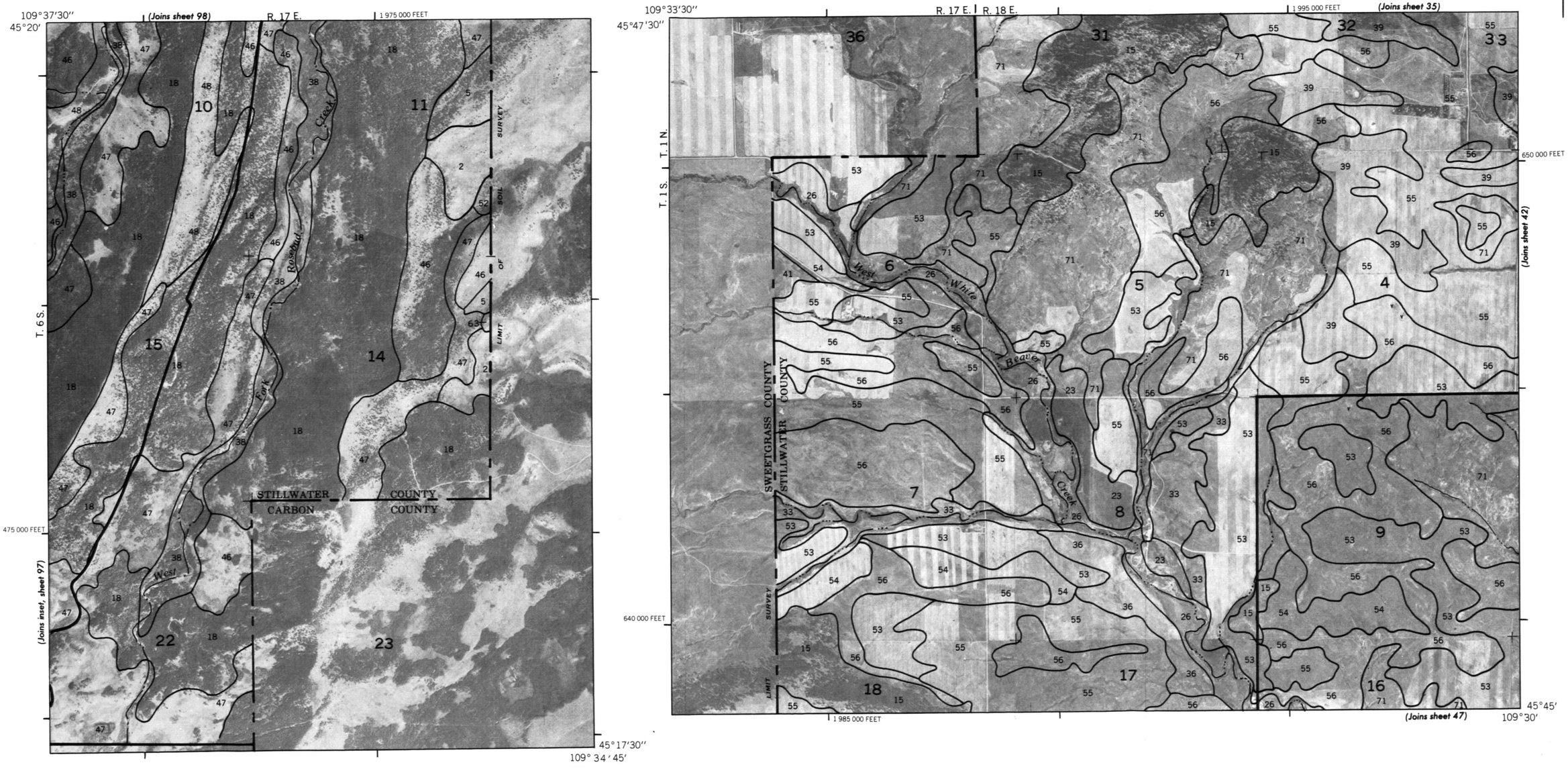
Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 40

N




1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 41

N

R. 18 E. | R. 19 E.

109°22′30″

45°47′30″

2 005 000 FEET

650 000 FEET

T. 1 S. | T. 1 N.

(Joins sheet 36)

(Joins sheet 41)

(Joins sheet 43)

640 000 FEET

45°45′

109°30′

(Joins sheet 48)

2 030 000 FEET

Spring Creek

Cottonwood Creek

Beaver Creek

White Creek

East Creek

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 42

N

109° 22′30″

45°47′30″

R. 19 E. R. 20 E.

(Joins sheet 37)

2 060 000 FEET

650 000 FEET

(Joins sheet 44)

T. 1 S. T. 1 N.

(Joins sheet 42)

640 000 FEET

2 035 000 FEET

(Joins sheet 49)

45°

109°15′

Cottonwood Creek

Keys Creek

Creek

Creek

Berry

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 43

N

2 065 000 FEET

(Joins sheet 38)

R. 20 E.

R. 21 E.

45

109°07′30″

45°47′30″

650 000 FEET

(Joins sheet 43)

T. 1 S.

(Joins sheet 45)

640 000 FEET

45°45′

109°15′

(Joins sheet 50)

2 095 000 FEET

North Fork Valley Creek

South Fork Valley Creek

Moulser

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 44

N

109° 07′ 30″

45° 47′30″

R. 21 E. | R. 22 E.

T. 1 S. | T. 1 N.

(Joins sheet 39)

2 125 000 FEET

650 000 FEET

(Joins sheet 44)

640 000 FEET

2 100 000 FEET

(Joins sheet 46)

(Joins sheet 51)

45° 45′

109°00′

North Fork

Valley

Creek

int

w

ϕ

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 45

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 46

N

2 130 000 FEET

(Joins sheet 40)

R. 22 E. | R. 23 E.

108°52′30″

45°47′30″

650 000 FEET

T. 1 S. | T. 1 N.

(Joins sheet 45)

640 000 FEET

45°45′

109°00′

(Joins sheet 52)

2 155 000 FEET

STILLWATER COUNTY

YELLOWSTONE COUNTY

LIMIT OF SOIL SURVEY

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 46

N



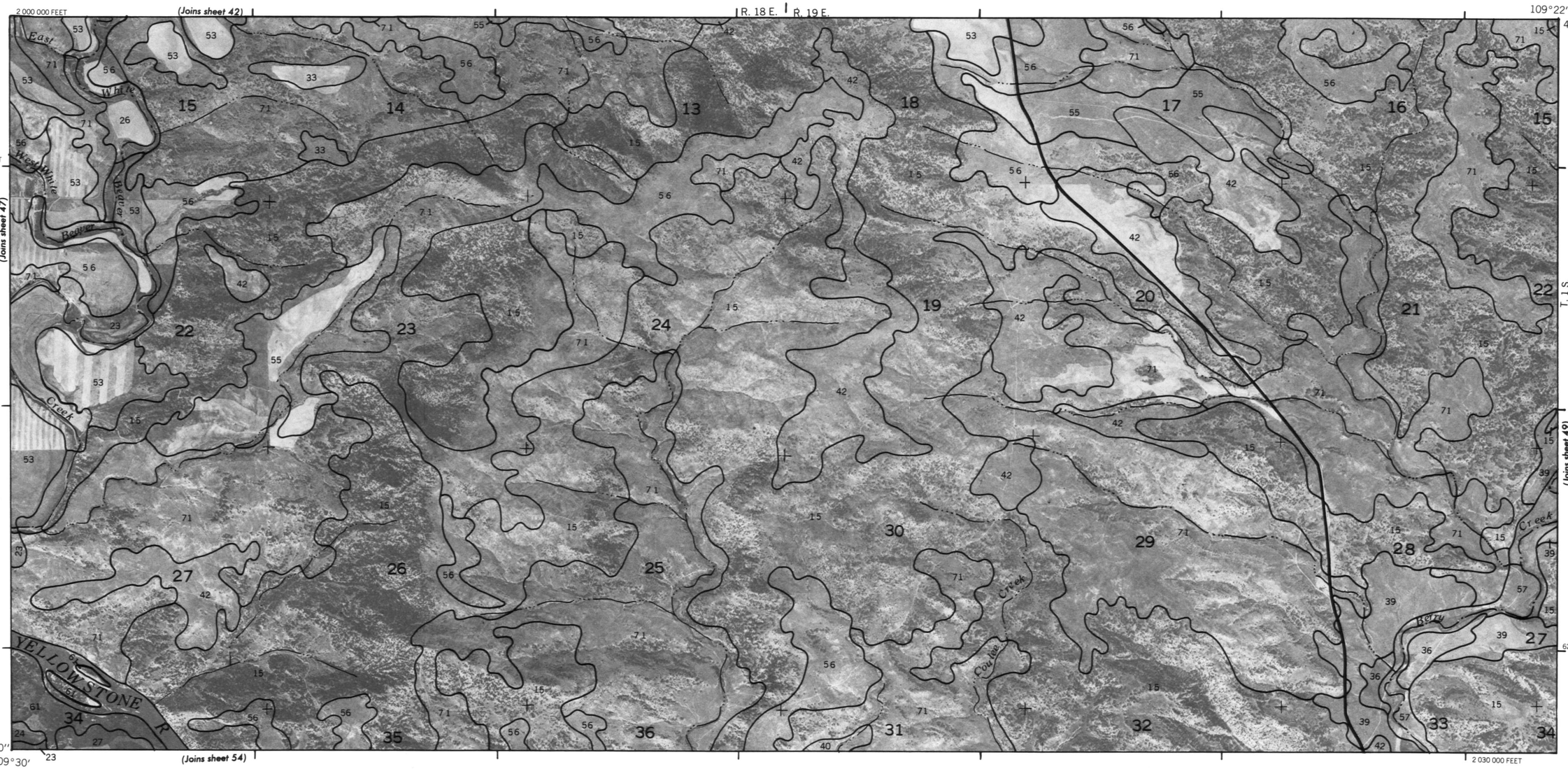
This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

109°37′30″
45°45′
108°52′30″
45°39′30″
R. 23 E.
2 165 000 FEET
605 000 FEET
R. 17 E.
R. 18 E.
2 000 000 FEET
635 000 FEET
T. 1 S.
T. 2 S.
595 000 FEET
625 000 FEET
1 970 000 FEET
2 160 000 FEET
45°37′30″
108°50′30″
45°42′30″
109°30′
(Joins sheet 41)
(Joins sheet 48)
(Joins sheet 64)
(Joins sheet 71)
(Joins sheet 53)
SOIL SURVEY OF YELLOWSTONE COUNTY
SOIL SURVEY OF STILLWATER COUNTY
SWEETGRASS
LIMIT
LIMIT OF SOIL SURVEY
YELLOWSTONE
STILLWATER
CO
CO
YELLOWSTONE RIVER
White Beaver Creek
ITALIAN DITCH
PACIFIC NORTHERN
BURLINGTON NORTHERN
REED POINT
18
17
16
19
20
21
30
29
28
27
26
23
22

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

N

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 48




1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 48

N

109°22′30″
45°45′

R. 19 E. R. 20 E.

2 060 000 FEET

(Joins sheet 43)

635 000 FEET

T. 1 S.

(Joins sheet 48)

625 000 FEET

2 035 000 FEET

(Joins sheet 50)

(Joins sheet 55)

45°42′30″
109°15′

Berry Creek

East Rosebud Creek

Wildcat Coulee

Keaster

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 49

N

2 065 000 FEET

(Joins sheet 44)

R. 20 E.

R. 21 E.

109°07′30″

45°45′

635 000 FEET

(Joins sheet 49)

T. 1 S.

(Joins sheet 51)

625 000 FEET

45°42′30″

109°15′

(Joins sheet 56)

2 095 000 FEET

Keyser Creek

East Keyser Creek

Hensley Creek

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 50

N

R. 21 E. R. 22 E.

109°07′30″

45°45′

(Joins sheet 45)

2 125 000 FEET

635 000 FEET

625 000 FEET

2 100 000 FEET

T. 1 S.

(Joins sheet 50)

(Joins sheet 52)

(Joins sheet 57)

45°42′30″

109°00′

South Fork

North Fork

Valley Creek

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 51

N

2 130 000 FEET

(Joins sheet 46)

R. 22 E.

R. 23 E.

108°52′30″

45°45′

635 000 FEET

(Joins sheet 51)

COUNTY

LIMIT OF SOIL SURVEY

STILLWATER

YELLOWSTONE

T. 1 S.

625 000 FEET

45°42′30″

109°00′

(Joins sheet 58)

2 155 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 52

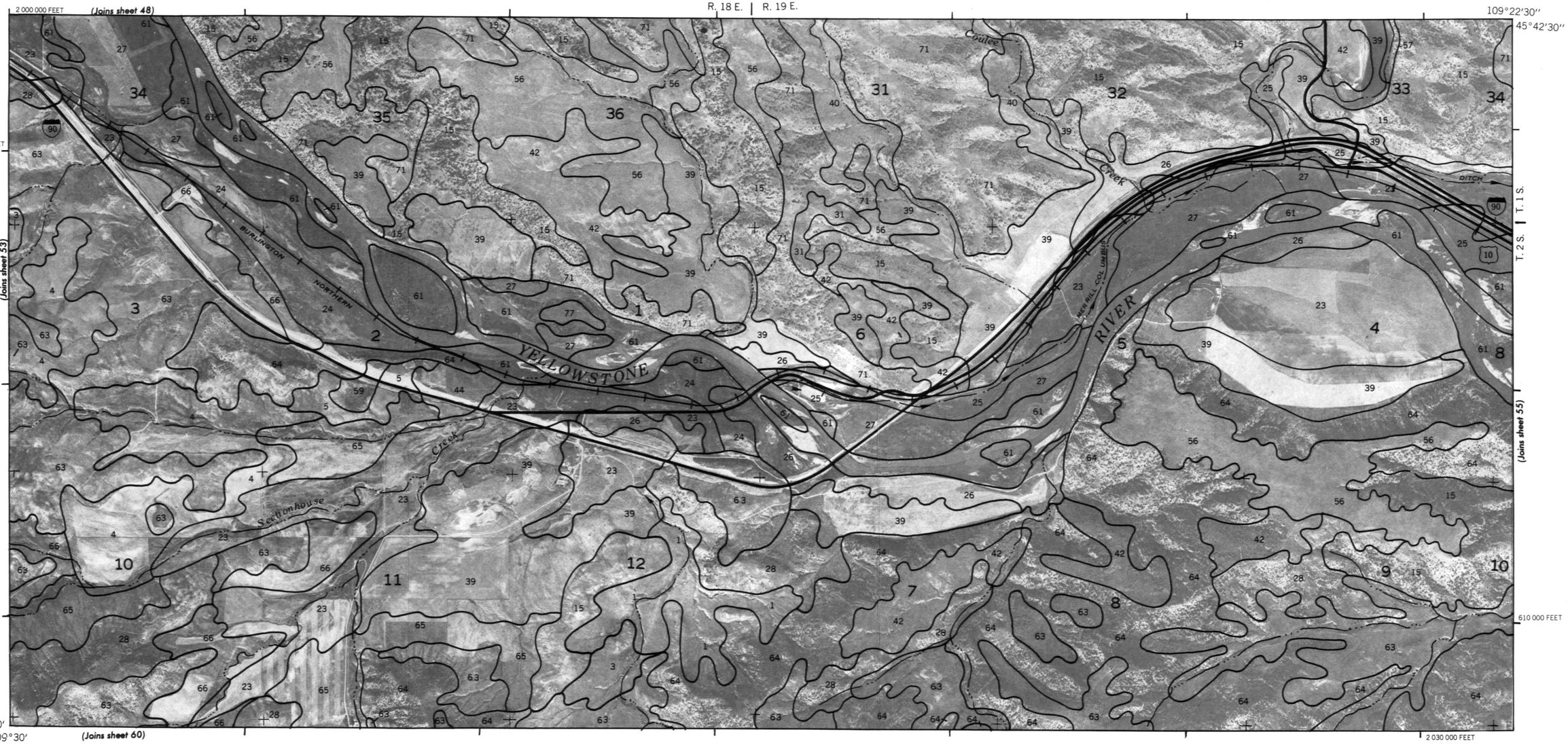
N

109°25′45″
46°02′30″
15
R. 19 E.
(Joins inset, sheet 2)
2 030 000 FEET
740 000 FEET
(Joins sheet 11)
T. 3 N.
SWEETGRASS COUNTY
STILLWATER COUNTY
LIMIT OF SOIL SURVEY
730 000 FEET
2 020 000 FEET
(Joins sheet 15)
46°00′
109°22′30″

109°34″
45°42′30″
R. 18 E.
(Joins sheet 47)
2 000 000 FEET
620 000 FEET
(Joins sheet 54)
T. 1 S.
T. 2 S.
REED POINT
Whistle Creek
Sectionhouse Creek
610 000 FEET
1 985 000 FEET
(Joins sheet 59)
45°40′
109°30′

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet
Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned




1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 54

N

109°22′30″
45°42′30″

R. 19 E. | R. 20 E.

(Joins sheet 49)

2 060 000 FEET

620 000 FEET

T. 2 S. | T. 1 S.

(Joins sheet 54)

610 000 FEET

(Joins sheet 56)

2 035 000 FEET

(Joins sheet 61)

45°40′
109°15′

YELLOWSTONE RIVER

BURLINGTON NORTHERN

COLUMBUS DITCH

Swift Coulee

Creek

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 55

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 56

N

2 065 000 FEET (Joins sheet 50)

R. 20 E. | R. 21 E.

109°07′30″

45°42′30″

620 000 FEET

(Joins sheet 55)

T. 2 S. | T. 1 S.

(Joins sheet 57)

610 000 FEET

45°40′

109°15′

(Joins sheet 62)

2 095 000 FEET

Hensley Creek

Dry Creek

Horse Creek

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 56

N

109°07′30″

45°42′30″

R. 21 E. | R. 22 E.

(Joins sheet 51) | 2 125 000 FEET

620 000 FEET

T. 2 S. | T. 1 S.

(Joins sheet 56)

(Joins sheet 58)

610 000 FEET

2 100 000 FEET

(Joins sheet 63)

45°40′

109°00′

North Fork Cottonwood Creek

Cottonwood Creek

Creek

Horse Creek

Swamp Creek

Swamp

Scale 1:24000

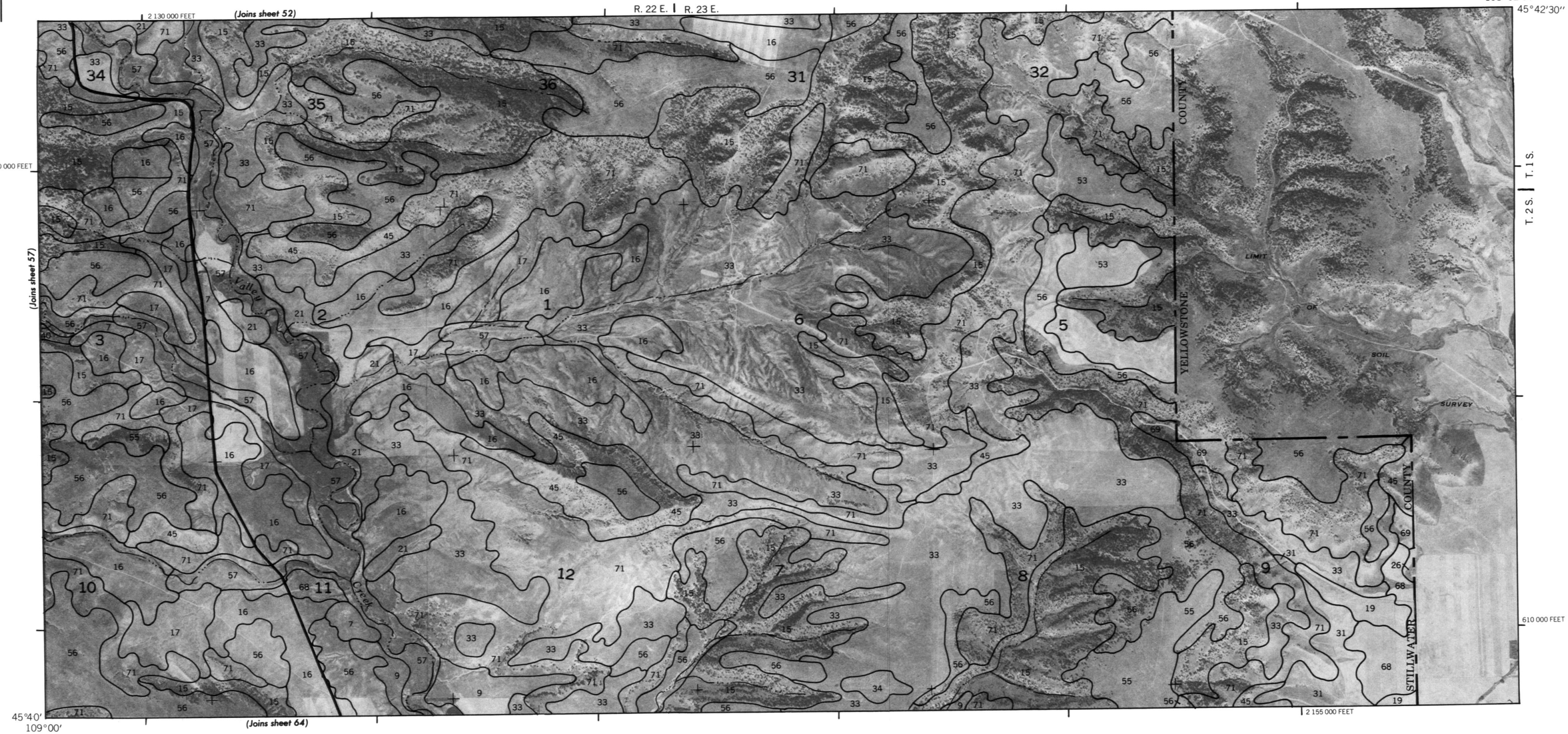
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 57

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 58




5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 58

N

INSET A

109°30′ 45°
45°57′30″
2 000 000 FEET

(Joins sheet 15)

710 000 FEET

(Joins sheet 20)

700 000 FEET

1 998 000 FEET

45°55′

109°30′

(Joins upper right)

2000 AND 5000-FOOT GRID TICKS

INSET B

2000 AND 5000-FOOT GRID TICKS

109°30′ 45°
45°55′
2 000 000 FEET

695 000 FEET

(Joins sheet 25)

685 000 FEET

1 998 000 FEET

45°52′30″

109°30′

(Joins inset A, sheet 35)

109°34′
45°40′
R. 17 E.
R. 18 E
(Joins sheet 53)
2 000 000 FEET

605 000 FEET

(Joins sheet 60)

595 000 FEET

1 985 000 FEET

(Joins sheet 66)

45°37′30″

109°30′

T. 2 S.

COUNTY
COUNTY

SWEET GRASS
STILLWATER

LIMIT OF SOIL SURVEY

Sectionhouse Creek
Countryman
North Fork
South Fork

16 17 18 19 20 21 28 29 30 33

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

60

N

2 000 000 FEET

(Joins sheet 54)

R. 18 E. R. 19 E.

109°22′30″

45° 4 0′

605 000 FEET

T. 2 S.

(Joins sheet 59)

(Joins sheet 61)

595 000 FEET

45°37′30″

109° 30′

(Joins sheet 67)

2 030 000 FEET

Countryman Creek

Coulee

Kennedy

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 60

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



109°22'30"
45°40'
R. 19 E.
R. 20 E.
T. 2 S
(Joins sheet 55)
2 060 000 FEET
605 000 FEET
595 000 FEET
2 035 000 FEET
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 68)
45°37'30"
109°15'
Smith Coulee
MERRILL-COLUMBUS
YELLOWSTONE
Columbus Creek
BURLINGTON
DITCH
WATER USERS
ASSOCIATION
COLUMBUS
Keyser
Creek
NORTHERN
RIVER
Creek
Huntley
STILLWATER R.
SHANE
DITCH
COLUMBUS
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

62

N

STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 62

2 065 000 FEET

(Joins sheet 56)

R. 20 E.

R. 21 E.

109°07'30"

45°40'

605 000 FEET

(Joins sheet 61)

595 000 FEET

T. 2 S.

(Joins sheet 63)

45°37'30"

109°15'

(Joins sheet 69)

2 095 000 FEET

COLUMBUS

YELLOWSTONE RIVER

Brown Creek

Dry Creek

Upper Willow Creek

Pitch

Burlington Northern

Water Users Association

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 62

N

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



109°07'30"
45°40'

R. 21 E. R. 22 E.

(Joins sheet 57) 2 125 000 FEET

605 000 FEET

(Joins sheet 64)

T. 2 S.

(Joins sheet 62)

595 000 FEET

2 100 000 FEET

(Joins sheet 70)

45°37'30"
109°00'

Allen Creek

Trail Gulch

Creek

COVE DITCH

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 64

N

109°45′
45°37′30″

1 965 000 FEET

590 000 FEET

580 000 FEET

1 940 000 FEET

T. 3 S.

SOIL SURVEY OF STILLWATER COUNTY LIMIT

R. 17 E.

STILLWATER COUNTY

SWEET GRASS COUNTY

Jackstone Creek

Jackstone Creek

(Joins sheet 66)

(Joins sheet 73)

45°35′
109°37′30″

28

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 65

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 66

N

R. 17 E. R. 18 E.

109°30′

45°37′30″

1 970 000 FEET

(Joins sheet 59)

590 000 FEET

(Joins sheet 65)

LIMIT OF SOIL SURVEY

COUNTY COUNTY

SWEET GRASS

STILLWATER

T. 3 S. | T. 2 S.

(Joins sheet 67)

Jackstone Creek

water

580 000 FEET

45°35′

109°37′30″

(Joins sheet 74)

2 000 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

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5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 66

N

109°30′
45°37′30″

R. 18 E. | R. 19 E.

(Joins sheet 60) 2 030 000 FEET

590 000 FEET

T. 2 S.
T. 3 S.

(Joins sheet 66)

(Joins sheet 68)

585 000 FEET

2 000 000 FEET

(Joins sheet 75)

45°35′
109°22′30″

Kennedy

Coffee

Pumpkin Creek

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 67

N

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 68

2 035 000 FEET

(Joins sheet 61)

R. 19 E. | R. 20 E.

109°15′

45°37′30″

590 000 FEET

(Joins sheet 67)

T. 3 S. | T. 2 S.

(Joins sheet 69)

580 000 FEET

45°35′

109°22′30″

(Joins sheet 76)

2 060 000 FEET

Hanley Creek

RIVER

STILLWATER

SHANE DITCH

Shane Ditch

Hill Ditch

SCOTT DITCH

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 68

N

109°15′
45°37′30″

R. 20 E. | R. 21 E.

(Joins sheet 62)

2 095 000 FEET

590 000 FEET

580 000 FEET

2 065 000 FEET

T. 3 S. | T. 2 S.

(Joins sheet 68)

(Joins sheet 70)

(Joins sheet 77)

63′

45°35′
109°07′30″

YELLOWSTONE RIVER

BURLINGTON NORTHERN

YELLOWSTONE

RIVER

COVE

DITCH

STILLWATER
CARBON
COUNTY

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

STILLWATER COUNTY AREA, MONTANA NO. 69

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 70

N

(Joins sheet 63)

2 100 000 FEET

R. 21 E. | R. 22 E.

109°00′

45°37′30″

590 000 FEET

(Joins sheet 69)

T. 3 S. | T. 2 S.

(Joins sheet 71)

580 000 FEET

45°35′

109°07′30″

2 125 000 FEET

Allen

Creek

Tilden Creek

DITCH

SURVEY

SOIL

LIMIT OF

NORTHERN

DITCH

COVE

BURLINGTON

BIG

RIVER

COUNTY

YELLOWSTONE

CARBON

90

10

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 70

N

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 71

R. 22 E. | R. 23 E.

2 130 000 FEET

590 000 FEET

108°52′30″

45°37′30″

(Joins sheet 64)

(Joins inset A, sheet 71)

(Joins sheet 70) T. 3 S. | T. 2 S.

45°35′

109°00′

2 160 000 FEET

580 000 FEET

INSET A

R. 23 E.

2 160 000 FEET

(Joins inset, sheet 47)

108°50′

45°37′30″

592 000 FEET

588 000 FEET

(Joins sheet 71)

45°36′30″

108°52′30″

2 175 000 FEET

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 72

N

INSET

109°52′30″

45°25′

(Joins sheet 91)

R. 15 E. | R. 16 E.

1 935 000 FEET

516000 FEET

513000 FEET

(Joins sheet 95)

1 905 000 FEET

45°24′15″

109°45′

3000 AND 5000-FOOT GRID TICKS

1 905 000 FEET

R. 15 E. | R. 16 E.

109°45′

45°34′

570 000 FEET

T. 3 S.

565 000 FEET

(Joins sheet 73)

45° 32′30″

109°52′30″

(Joins sheet 78)

1 935 000 FEET

10 11 12 7 8 9 19 20 21 29 30 28

STILLWATER RIVER

Rock Creek

SWEETGRASS COUNTY

STILLWATER COUNTY

LIMIT OF SOIL SURVEY

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 72

N

109°45′

45°35′

R. 16 E.

R. 17 E.

(Joins sheet 65)

1 965 000 FEET

675 000 FEET

LIMIT OF SOIL SURVEY

STILLWATER COUNTY

SWEETGRASS COUNTY

T. 3 S.

(Joins sheet 72)

565 000 FEET

1 940 000 FEET

(Joins sheet 74)

(Joins sheet 79)

45°32′30″

109°37′30″

Cow Creek

Spring Creek

Dry Gulch

Little Spring Creek

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

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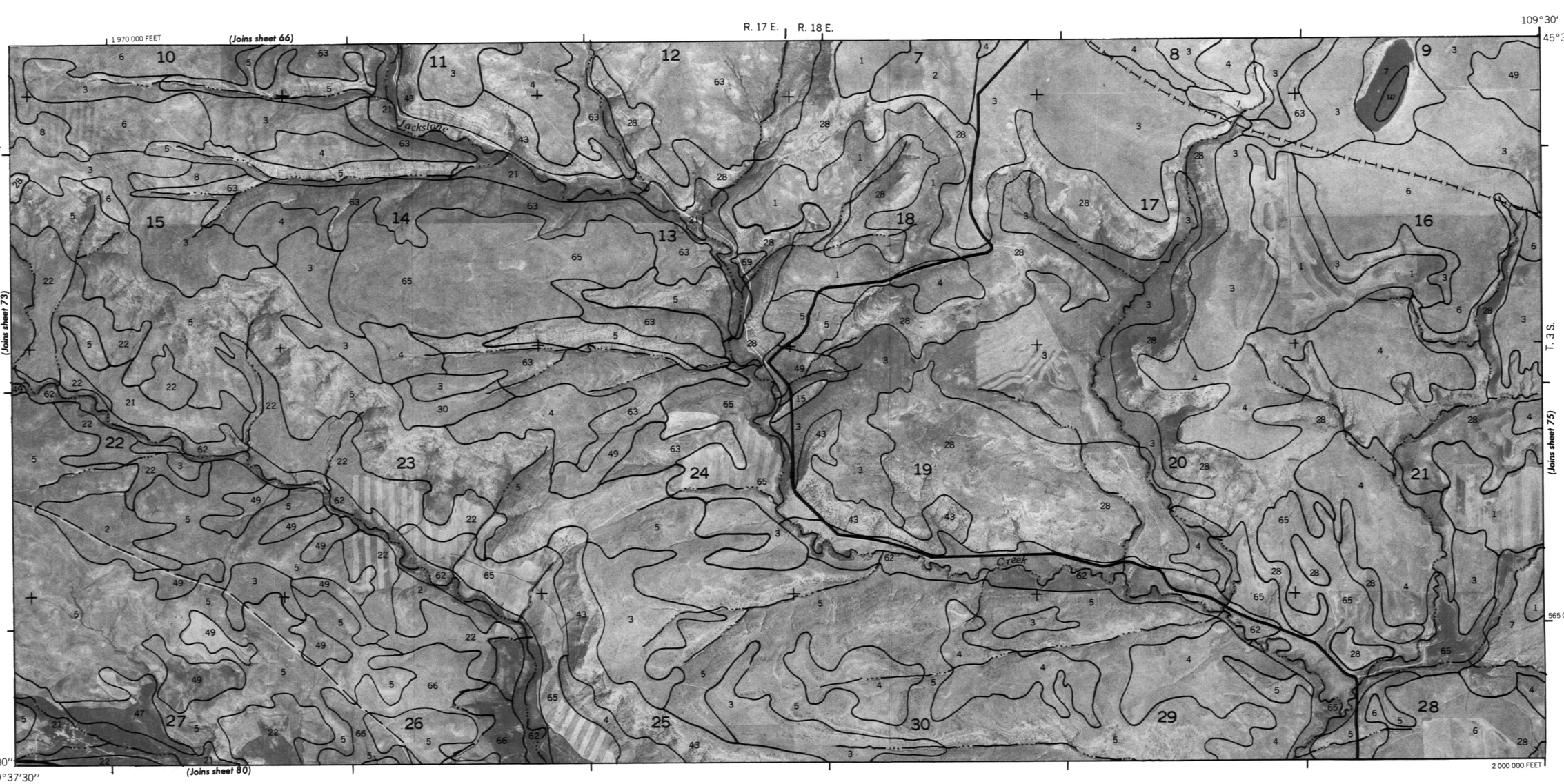
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 73




Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 74

N

109°30′

45°35′

R. 18 E. | R. 19 E.

(Joins sheet 67)

2 030 000 FEET

580 000 FEET

T. 3 S.

(Joins sheet 74)

(Joins sheet 76)

570 000 FEET

2 000 000 FEET

(Joins sheet 81)

45′32′30″

109°22′30″

Buck Creek

GARRISON DITCH

GARRISON RIVER

STILLWATER

NICHOLS DITCH

ROADHOUSE DITCH

307

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 75

(Joins sheet 68)

2 035 000 FEET

R. 19 E. | R. 20 E.

109°15′

45°35′

575 000 FEET

(Joins sheet 75)

T. 3 S.

(Joins sheet 77)

565 000 FEET

45°32′30″

109°22′30″

(Joins sheet 82)

2 060 000 FEET

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 76

N

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



109°15′
45°35′
R. 20 E.
R. 21 E.
(Joins sheet 69)
2 095 000 FEET
575 000 FEET
565 000 FEET
2 065 000 FEET
T. 3S.
(Joins sheet 76)
(Joins sheet 83)
45°32′30″
109°07′30″
STILLWATER COUNTY
CARBON COUNTY
LIMIT OF SOIL SURVEY
Sharp Creek
Tutt Creek

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

78

N

1 905 000 FEET

560 000 FEET

45°30′

109°52′30″

(Joins sheet 72)

R. 16 E.

109°45′

45°32′30″

T. 4 N. | T. 3 N.

(Joins sheet 79)

550 000 FEET

(Joins sheet 84)

1 935 000 FEET

COUNTY

COUNTY

SWEET GRASS

STILLWATER

LIMIT OF SOIL SURVEY

BOUNDARY

FOREST

NATIONAL

Trail

Road

Canyon

Creek

30 29 28 31 32 33 6 5 4 7 8 9

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 78

STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 79



N

109°45′

45°32′30″

R. 16 E. | R. 17 E.

(Joins sheet 73) | 1 965 000 FEET

560 000 FEET

(Joins sheet 80)

T. 4 N. | T. 3 N.

(Joins sheet 78)

550 000 FEET

1 940 000 FEET

45°30′

109°37′30″

(Joins sheet 85)

Trout Creek

Spring Creek

STILLWATER RIVER

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

80

N

R. 17 E. | R. 18 E.

109°30′

45°32′30″

1 970 000 FEET

(Joins sheet 74)

560 000 FEET

(Joins sheet 79)

T. 3 S. | T. 4 S.

(Joins sheet 81)

550 000 FEET

45°30′

109°37′30″

(Joins sheet 86)

2 000 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 80

N

109°30′
45°32′30″

R. 18 E. | R. 19 E.

(Joins sheet 75) 2 030 000 FEET

560 000 FEET

T. 3 S.
T. 4 S.

(Joins sheet 80)

(Joins sheet 82)

550 000 FEET

2 000 000 FEET

(Joins sheet 87

45°30′
109°22′30″

ABSAROKEE

STILLWATER RIVER

CANYON CREEK

PITCH

Rosebud

Creek

Beaver

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 81

N

2 035 000 FEET

(Joins sheet 76)

R. 19 E. | R. 20 E.

109°15'

45°32'30"

560 000 FEET

(Joins sheet 81)

T. 4 S. | T. 3 S.

(Joins sheet 83)

550 000 FEET

45°30'

109°22'30"

(Joins sheet 88)

2 060 000 FEET

Whitebird Creek

Joe Hill Creek

Mexican Joe Creek

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 82

N

109°15′
45°32′30″

R. 20 E. | R. 21 E.

(Joins sheet 77)

2 095 000 FEET

560 000 FEET

T. 4 S. | T. 3 S.

(Joins sheet 82)

550 000 FEET

2 065 000 FEET

(Joins sheet 89)

45°30′
109°07′30″

East Fork Shane Creek

West Fork Shane Creek

Shane Creek

Coal Creek

STILLWATER COUNTY

CARBON COUNTY

LIMIT OF SOIL SURVEY

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 83

84

N

1 905 000 FEET

(Joins sheet 78)

R. 16 E.

109°45′

45°30′

545 000 FEET

T. 4 S.

535 000 FEET

(Joins sheet 85)

(Joins inset, sheet 90)

LIMIT OF SOIL SURVEY

GALLATIN NATIONAL FOREST BOUNDARY

STILLWATER RIVER

45°27′30″

109°52′30″

(Joins sheet 91)

R. 15 E.

R. 16 E.

1 935 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

STILLWATER COUNTY AREA, MONTANA NO. 84

N

109°45′
45°30′

R. 16 E. R. 17 E.

(Joins sheet 79)

1 965 000 FEET

545 000 FEET

(Joins sheet 86)

T. 4 S.

(Joins sheet 84)

535 000 FEET

1 940 000 FEET

(Joins sheet 92)

45°27′30″
109°37′30″

Bad Canyon

RIVER

Creek

37 Creek

BEEHIVE

STILL WATER

Midnight

Fork

Grove Creek

North Grove Creek

9 10 11 12 7 8 9
16 15 14 13 18 17 16
21 22 23 24 19 20 21
28 27 26 25 30 29 28

This map was compiled on 1976 U. S. Department of The Interior. Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 86

N

R. 17 E. | R. 18 E.

1 970 000 FEET

(Joins sheet 80)

109°30′

45°30′

545 000 FEET

(Joins sheet 85)

(Joins sheet 87)

535 000 FEET

T. 4 S.

45°27′30″

109°37′30″

(Joins sheet 93)

2 000 000 FEET

North Fork

South Fork

Grove Creek

Rose Bud Creek

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 86

N

STILLWATER COUNTY AREA, MONTANA NO. 87

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

109°30′
45°30′
R. 18 E.
R. 19 E.
(Joins sheet 81)
2 030 000 FEET
545 000 FEET
T. 4 S.
(Joins sheet 86)
535 000 FEET
2 000 000 FEET
(Joins sheet 94)
(Joins sheet 88)
45°27′30″
109°22′30″

Rosebud Creek
East Rosebud Creek
Butcher Creek
Beaver Creek
West Rosebud DITCH
WOODARD DITCH

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 88

N

2 030 000 FEET

(Joins sheet 82)

R. 19 E. | R. 20 E.

109°15′

45°30′

545 000 FEET

(Joins sheet 87)

T. 4 S.

(Joins sheet 89)

535 000 FEET

Whitebird Creek

Yoke Creek

Hill

LIMIT OF SOIL SURVEY

STILLWATER COUNTY

CARBON COUNTY

45°27′30″

109°22′30″

(Joins inset, sheet 89)

2 060 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 88

89

N

STILLWATER COUNTY AREA, MONTANA NO. 89

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

2 065 000 FEET

(Joins sheet 83)

R. 20 E.

109°07′30″

45°30′

545 000 FEET

T. 4 S.

(Joins sheet 88)

West Fork Shane Creek

STILLWATER COUNTY

CARBON COUNTY

LIMIT OF SOIL SURVEY

R. 20 E.

45°27′30″

109°15′

535 000 FEET

2 095 000 FEET

INSET B

109°22′30″

45°27′30″

(Joins sheet 88, lower left)

2 037 000 FEET

531 000 FEET

(Joins sheet 94, upper right)

529 000 FEET

LIMIT OF SOIL SURVEY

2 033 000 FEET

45°26′55″

109°21′45″

2000 AND 4000-FOOT GRID TICKS

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

# STILLWATER COUNTY AREA, MONTANA — SHEET NUMBER 90

875 000 FEET
545 000 FEET
530 000 FEET
1 895 000 FEET
R. 15 E.
109°52′30″
45°29′45″
535 000 FEET
1 900 000 FEET
45°27′30″
109°55′45″
45°25′
110°00′
(Joins sheet 90)
LIMIT OF SOIL SURVEY
FOREST BOUNDARY
(Joins left inset)
R. 15 E.
109°52′30″
45°27′30″
520 000 FEET
(Joins sheet 91)
SWEET GRASS COUNTY
STILLWATER COUNTY
T. 4 S.
T. 5 S.
FORK
STILLWATER
RIVER
WEST

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet
Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.
This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

STILLWATER COUNTY AREA, MONTANA NO. 90

N

STILLWATER COUNTY AREA, MONTANA NO. 91

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 905 000 FEET

R. 15 E. | R. 16 E.

(Joins sheet 84)

109°45′

45°27′30″

530 000 FEET

T. 4 S.

T. 5 S.

(Joins sheet 90)

(Joins sheet 92)

520 000 FEET

RIVER

STILLWATER

(Joins sheet 72)

45°25′

109°52′30″

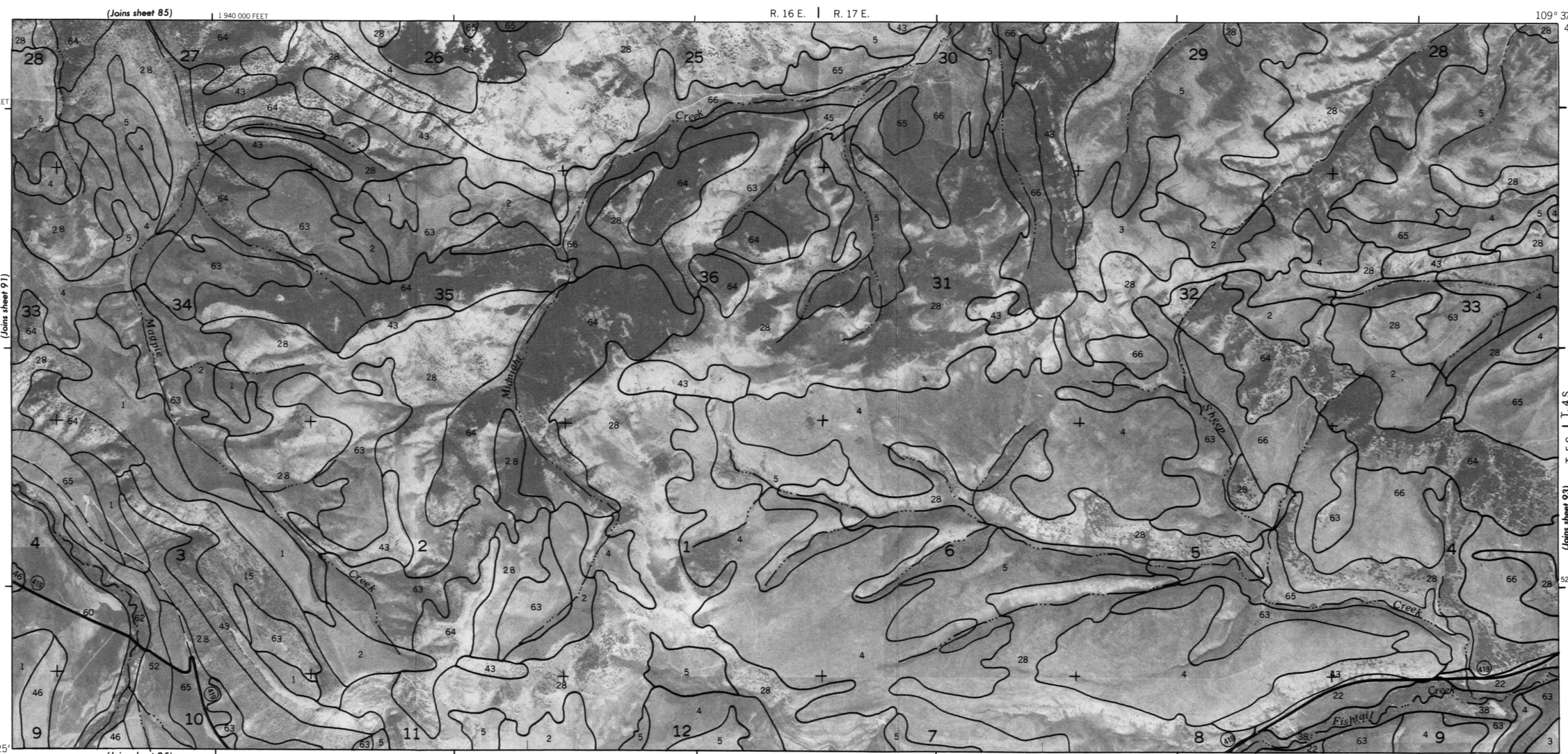
1 935 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

N




1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24000

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5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 92

N

109°37′30″
45°27′30″

R. 17 E. | R. 18 E.

T. 4 S. | T. 5 S.

(Joins sheet 86)

(Joins sheet 92)

(Joins sheet 94)

(Joins sheet 96)

2 000 000 FEET

530 000 FEET

5 200 000 FEET

1 970 000 FEET

45°25′
109°30′

Creek

Rosebud

Rosebud

West

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 93

N

2 000 000 FEET

530 000 FEET

(Joins sheet 87)

R. 18 E. | R. 19 E.

109°22′30″

45°27′30″

T. 4 S.

T. 5 S.

(Joins sheet 93)

(Joins inset, sheet 89)

520 000 FEET

LIMIT OF SOIL SURVEY

STILLWATER COUNTY

CARBON COUNTY

Butcher Creek

Beaver Creek

Roxebud Creek

Antelope Creek

45°25′

109°30′

(Joins inset A, sheet 98)

R. 18 E. | R. 19 E.

2 030 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

STILLWATER COUNTY AREA, MONTANA NO. 94

N

109°45′
45°25′

R. 16 E. | R. 17 E.

(Joins sheet 92) | 1 965 000 FEET

515 000 FEET

(Joins sheet 96)

T. 5 S.

CUSTER NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

DEAN

Fishtail Butte

Meadow Creek

Creek

Fishtail

(Joins inset, sheet 72)

505 000 FEET

1 940 000 FEET

(Joins sheet 97)

45°22′30″
109°37′30″

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

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STILLWATER COUNTY AREA, MONTANA NO. 95

96

N

1 970 000 FEET

(Joins sheet 93)

R. 17 E.

R. 18 E.

109°30′

45°25′

515 000 FEET

(Joins sheet 95)

T. 5 S.

(Joins inset A, sheet98.)

505 000 FEET

Creek

Fishtail

Rosebud

West

Creek

Creek

Fiddler

Creek

Ingersoll

Creek

STILLWATER CO.

CARBON COUNTY

LIMIT OF SOIL SURVEY

STILLWATER COUNTY

CARBON COUNTY

45°22′30″

109°37′30″

(Joins sheet 98)

2 000 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

STILLWATER COUNTY AREA, MONTANA NO. 96

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

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N

109°40 15′ 45°20′ (Joins lower right, sheet 97) R. 17 E. 1 965 000 FEET 395 000 FEET (Joins inset, sheet 41)

T. 6 S.

CUSTER NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

475 000 FEET

1 960 000 FEET 45°17′30″ 109°37′30″

109°41′30″ 45°22′30″ R. 17 E. (Joins sheet 95) 1 965 000 FEET 500 000 FEET (Joins sheet 98)

T. 5 S. T. 6 S.

LIMIT OF SOIL SURVEY

CUSTER NATIONAL FOREST BOUNDARY

1 955 000 FEET (Joins upper left inset, sheet 97) 45°20′ 109°37′30″

Fiddler Creek

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

This map was compiled on 1976 U S Department of The Interior, Geological Survey orthophotography by the U S Department of Agriculture, Soil Conservation Service and cooperating agencies. 5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 97

N

1 970 000 FEET

(Joins sheet 96)

R. 17 E.

R. 18 E.

109°30′

45°22′30″

500 000 FEET

(Joins sheet 97)

LIMIT OF SOIL SURVEY

T. 5 S.

T. 6 S.

Rosebud Creek

West Fork

INSET A

2 000 000 FEET

(Joins sheet 94)

109°28′45″

45°25′

516 000 FEET

(Joins sheet 96, upper right)

STILLWATER CO

CARBON COUNTY

LIMIT OF SOIL SURVEY

510 000 FEET

45°23′30″

109°30′

2 005 000 FEET

T. 6 S. | T. 5 S.

490 000 FEET

45°20′

109°37′30″

(Joins inset, sheet 41)

2 000 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

This map was compiled on 1976 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

STILLWATER COUNTY AREA, MONTANA NO. 98